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Project Technical Requirements Specification for the International Low Impact Docking System (iLIDS)

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Lyndon B. Johnson Space Center
Houston, Texas 77058

Project Technical Requirements Specification for the International Low Impact Docking System (iLIDS)

Prepared by:

James Lewis 11-15-10
James L. Lewis Date
Project Manager, EA3

Approved by:

Gregg C. Baumer 11/15/10
Gregg C. Baumer Date
S&MA Integration Manager, NT311

Bruce W. Sauser 11-15-10
Bruce Sauser Date
Systems Architecture and Integration Office, Manager, EA3-1

Caris A. Hatfield 11-15-10
Caris (Skip) A. Hatfield Date
NDSP Project Manager, OA

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1 INTRODUCTION

1.1 Purpose and Scope

The NASA Docking System (NDS) is NASA's implementation for the emerging International Docking System Standard (IDSS) using low impact docking technology. The NASA Docking System Project (NDSP) is the International Space Station (ISS) Program's project to produce the NDS, Common Docking Adapter (CDA) and Docking Hub. The NDS design evolved from the Low Impact Docking System (LIDS). The acronym international Low Impact Docking System (iLIDS) is also used to describe this system as well as the Government Furnished Equipment (GFE) project designing the NDS for the NDSP. NDS and iLIDS may be used interchangeability. This document will use the acronym iLIDS. Some of the heritage documentation and implementations (e.g. software command names, requirement ID, figures, etc.) used on NDS will continue to use the LIDS acronym.

This specification defines the technical requirements for the iLIDS GFE delivered to the NDSP by the iLIDS project. This document contains requirements for two iLIDS configurations, SEZ29101800-301 and SEZ29101800-302. Requirements with the statement, "iLIDS shall", are for all configurations. Examples of requirements that are unique to a single configuration may be identified as "iLIDS (-301) shall" or "iLIDS (-302) shall". Furthermore, to allow a requirement to encompass all configurations with an exception, the requirement may be designated as "iLIDS (excluding -302) shall".

Verification requirements for the iLIDS project are identified in the Verification Matrix (VM) provided in the iLIDS Verification and Validation Document, JSC-63966.

The following definitions differentiate between requirements and other statements:

Shall:	This is the only verb used for the binding requirements.
Should/May:	These verbs are used for stating non-mandatory goals.
Will:	This verb is used for stating facts or declaration of purpose.

A "Definition of Terms" table is provided in Appendix B to define those terms with specific tailored uses in this document.

1.2 Responsibility and Change Authority

This document is prepared and maintained in accordance with EA-WI-023, Project Management of GFE Flight Projects. The responsibility for the development of this document lies with the Systems Architecture and Integration Office (EA3). The NDS Project Office will serve as the change authority.

2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 Applicable Documents

The following documents, of the exact issue and revision shown, form a part of this specification, to the extent specified herein.

Table 2.1-1 - Applicable Documents

Document Number	Revision/ Release Date	Document Title
ANSI/TIA/EIA-422B	B 9/16/2005	Electrical Characteristics of Balanced Voltage Digital Interface Circuits
D684-14211-01	Draft No date	iLIDS FRAM Connector Test Evaluation
JPR 5322.1	G 6/30/09	Contamination Control Requirements
JPR 8080.5	A 1 5/1/2009	JSC Design and Procedural Standards
JPR 8730.2	Baseline May 30, 2007	JSC Fastener Integrity Testing Program
JSC-27301	F 08-2009	Materials Control Plan for JSC Flight Hardware
JSC-28918	Baseline February 2005	Extravehicular Activity (EVA) Design Requirements and Considerations
JSC-62809	Rev D April 22, 2010	Human Rated Spacecraft Pyrotechnic Specification
JSC-64598	Draft No date	iLIDS Ionizing Radiation Control Plan
JSC-64599	Draft No date	iLIDS Electric Power Quality Description Document
JSC-64924	Draft No date	iLIDS Electrical, Electronic and Electromechanical (EEE) Parts Management and Implementation Plan
JSC-65795	Revision A July, 2010	International Low Impact Docking System (iLIDS) Interface Definition Document (IDD)
JSC-65842	Draft No date	iLIDS Electromagnetic Environmental Effects (E3) Requirements
JSC-65970	Draft No date	iLIDS Thermal and Induced Environments (TIES)
MIL-STD-130	M, Change 1 12/2/2005	Identification Marking of U.S. Military Property
MIL-STD-1553B	B 30 April 1975	Military Standard Aircraft Internal Time Division Command/Response Multiplex Data Bus
NASA-STD-4003	Baseline 9/8/2003	Electrical Bonding for NASA Launch Vehicles, Spacecraft, Payloads, and Flight

Document Number	Revision/ Release Date	Document Title
		Equipment
NASA-STD-5005	C 7/20/2007	Ground Support Equipment
NASA-STD-5017	Baseline 6/13/2006	Design and Development Requirements for Mechanisms
NASA-STD-6016	Baseline 07-11-2008	Standard Material and Processes Requirements for Spacecraft
NASA-STD-8719.13	B, Change 1 7/8/2004	Software Safety Standard
NASA-STD-8739.8	Baseline 7/28/2004	NASA Software Assurance
NASA/TP-2002-210780	Baseline May 2002	The New NASA Orbital Debris Engineering Model ORDEM2000
NPR 6000.1	G 3/28/2005	Requirements for Packaging, Handling, and Transportation of Aeronautical and Space Systems, Equipment and Associated Components
NPR 7150.2	N/A 9/27/2004	NASA Software Engineering Requirements
SN-C-0005	D 7/20/1998	Contamination Control Requirements
SSP 30233	H August 21, 2007	Space Station Requirements for Materials and Processes
SSP 30234	Rev F DCN 1 July 2002	Failure Modes and Effects Analysis and Critical Items List Requirements for Space Station
SSP 30309	Rev. F 10/24/2009	Safety Analysis and Risk Assessment Requirements Document
SSP 30425	Rev B 02/08/1994	Space Station Program Natural Environment Definition for Design
SSP 30426	D 1/1/1994	Space Station External Contamination Control Requirements
SSP 30558	C Aug. 2001	Fracture Control for Space Station
SSP 30559	D July 27, 2007	Structural Design and Verification Requirements
SSP 41000	BN 3/16/2009	System Specification for the International Space Station
SSP 41172	Y 5/23/2007	Qualification and Acceptance Environmental Test Requirements
SSP 50005	E 6/6/2009	International Space Station Flight Crew Integration Standard (NASA-STD-3000/T)

Document Number	Revision/ Release Date	Document Title
SSP 50006	Rev A August, 1994	International Space Station Internal & External Decals & Placards Specification
SSP 50038	Revision B November 17, 1995	Computer-Based Control System Safety Requirements
SSP 50254	L 7/26/2006	International Space Station Program Operations Nomenclature
N/A	Current	Webster's New World Dictionary of American English

2.2 Reference Documents

The following documents are reference documents utilized in the development of this specification.

Table 2.2-1 - Reference Documents

Document Number	Revision/ Release Date	Document Title
EA-WI-023	Revision E 2/6/2009	Project Management of Government Furnished Equipment (GFE) Flight Projects
JSC-25863	A 8/1/1998	Fracture Control Plan for JSC Flight Hardware
NPR 8705.2	C 2008	Human Rating Requirements and Guidelines
NSTS 07700	Rev M June 9, 1999	Vol. X, Space Shuttle Flight and Ground System Specification Book 2, Environment Design, Weight, and Performance, and Avionics Events
SSP 41004	H October 20, 1998	Common Berthing Mechanism to Pressurized Elements Interface Control Document Part 1
SSP 50008	Revision D 17 June 2005	International Space Station Interior Color Scheme
SSP 50021	Basic 9/1/1996	Space Station Safety Requirements

2.3 Order of Precedence

In the event of a conflict between the text of this specification and an applicable document cited herein, the text of this specification takes precedence except for JSC-65795, International Low Impact Docking System (iLIDS) Interface Definition Document (IDD). This document uses the following three methods to invoke requirements from applicable documents:

1) The requirement is written directly from the applicable document

2) The entire document is invoked as applicable

3) An entire document is invoked as applicable with cited exceptions

3 REQUIREMENTS

3.1 International Low Impact Docking System General Requirements

3.1.1 iLIDS GFE Description

The iLIDS mating system supports low approach velocity docking and provides a modular and reconfigurable standard interface, supporting crewed and autonomous vehicles during mating and assembly operations.

The iLIDS is an androgynous peripheral docking system. It facilitates low approach velocity docking via a reconfigurable, active, closed-loop, force-feedback controlled mating system using modern technologies. The iLIDS supports both crewed and autonomous vehicles during mating and assembly operations. In addition, it is modular and reconfigurable for a variety of missions. Future iLIDS configurations will be certified to allow docking at positive, zero, and negative approach velocities, as well as berthing.

The iLIDS system establishes the initial contact of two vehicles through a Soft Capture System (SCS), which uses the low impact docking technology. This system consists of guide petals, magnets, magnetic striker plates, electromechanical actuators in a Stewart Platform configuration, and load sensing rings. During docking soft capture, the guide petals are the first to make contact, transferring contact/load inputs into the load sensing load cells. The load cells provide information to drive the electromechanical actuators to correct lateral and angular misalignment between the two opposing interfaces. Soft capture completes when electromagnetic attachment of the magnets to the striker plates on the opposing capture ring occurs.

The hard capture subsystem uses powered hooks to engage with another iLIDS in passive mode, providing a structural connection ready for pressurization between the mated vehicles that allows for cargo and crew transfer. The Hard Capture System (HCS) consists of a tunnel, 12 active/passive hook pairs, seals, and mechanized separation/umbilicals. The docking is complete when mechanized resource transfer umbilicals are extended and engaged with the spring-load separation system energized for undocking.

The iLIDS is a docking system that can be commanded via iLIDS electronics interface from the host in either an active mode or a passive mode. Active mode is when the iLIDS commands the soft capture and all sequences of docking. Passive mode is when the iLIDS yields control and allows the iLIDS, in active mode, to mate to it. See the iLIDS figure below.

In support of the NASA Docking System Project (NDSP), two iLIDS configurations are used: the iLIDS-301 and the iLIDS-302.

The iLIDS-301 is a standalone assembly with all required hardware (e.g. MMOD, electrical boxes, etc.) contained in the assembly. The iLIDS-301 can dock to another iLIDS-301 or to iLIDS-302.

The iLIDS-302 has most of the same functionality as the iLIDS-301. The main difference is the electrical boxes are integrated in the host vehicle rather than the docking system assembly. Hence, the tunnel structure is shorter (i.e. compact). In addition, the iLIDS-302 relies on the host for Micro Meteoroid Orbital Debris (MMOD) shielding. Further, the iLIDS-302 does not contain a seal on the mating surface which would support longer duration missions such as for the ISS CDA. Therefore the iLIDS-302 can only dock to iLIDS-301. However, the iLIDS-302 will not be initially certified to perform powered soft capture.

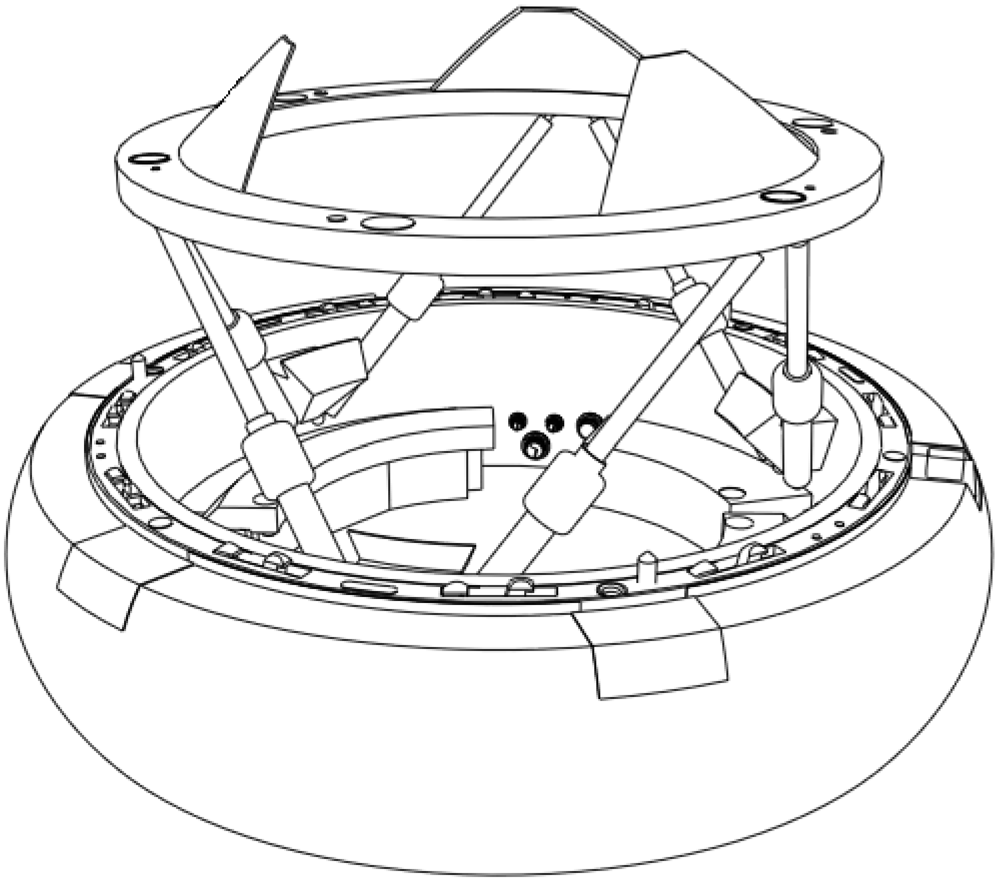
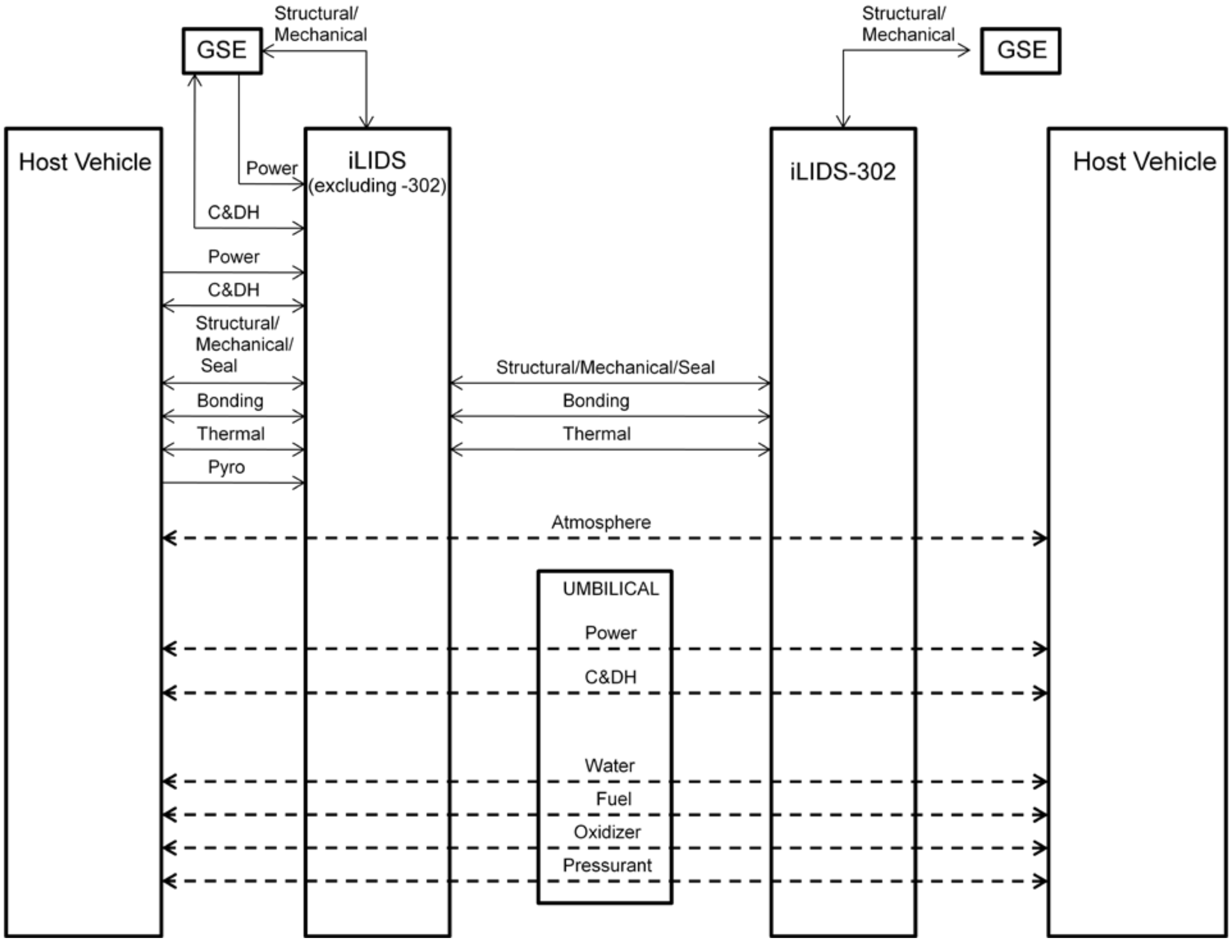


Figure 3.1-1 – iLIDS-301

3.1.2 iLIDS Interface Requirements

From a high-level system perspective, an iLIDS unit will have the following interfaces:

- iLIDS-to-Vehicle.
- iLIDS (chaser vehicle)-to-iLIDS (mating vehicle).
- iLIDS-to-Ground Support Equipment (GSE). The iLIDS System Interface Diagram below shows the functions crossing each interface.



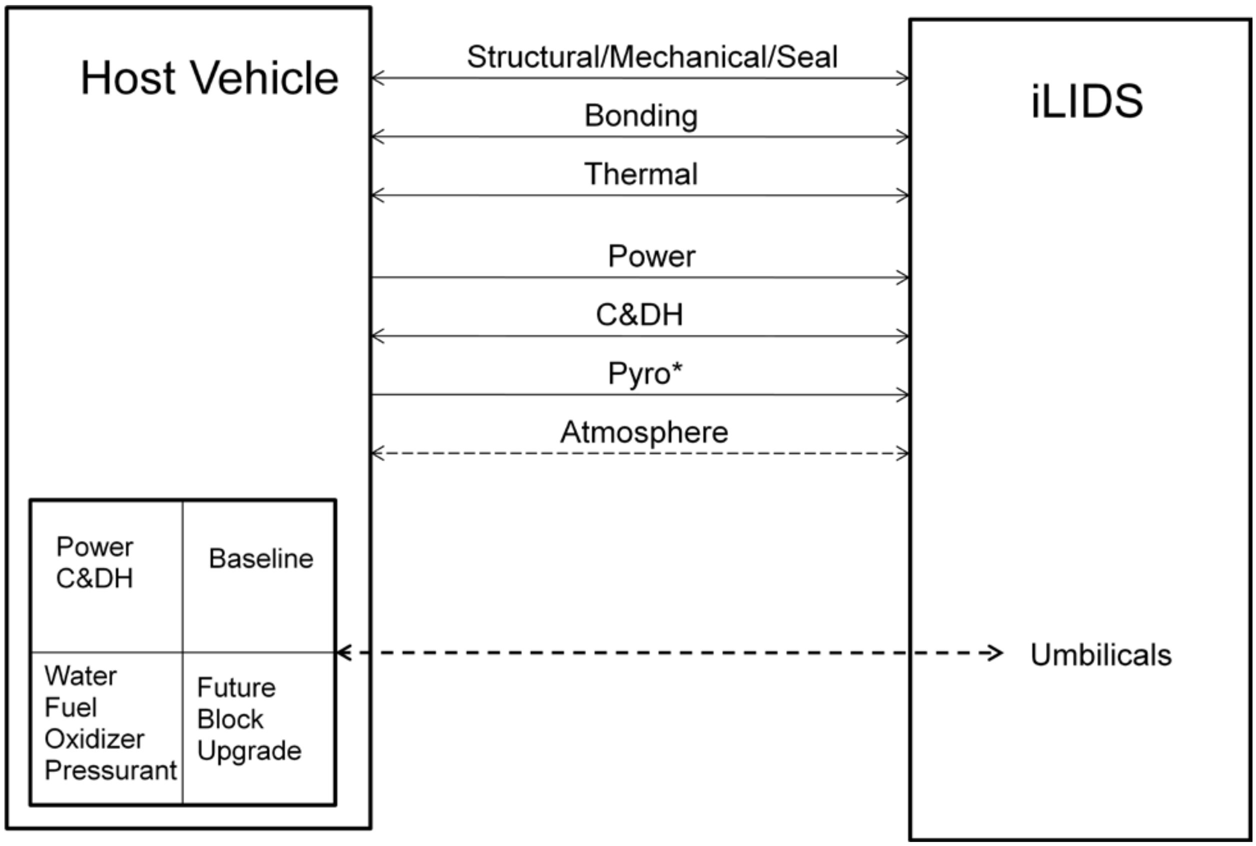
__________Solid lines = functional interfaces
_ _ _ _ _ _ _ _ Dashed lines = pass through resources vehicle to vehicle

Figure 3.1-2 - iLIDS System Interface Diagram

3.1.2.1 iLIDS-to-Vehicle Interface

The iLIDS incorporates the following interface functions to the Vehicle:

- iLIDS supports structural/mechanical attachment to the Vehicle.
- iLIDS receives power from the Vehicle.
- iLIDS supports vehicle-to-vehicle transfer of atmosphere, power, data, and communications. Future configurations will include water, fuel, oxidizer, and pressurant.
- iLIDS supports electrical bonding to the Vehicle.
- In addition, the iLIDS incorporates the following interface functions to the Vehicle:
- iLIDS supplies data to the Vehicle.
- iLIDS receives commands from the Vehicle.
- iLIDS (excluding -302) receives pyrotechnic controller signals from the Vehicle.



Note: * denotes Pyro is not an interface on iLIDS-302
__________ Solid lines = functional interfaces
_ _ _ _ _ _ _ Dashed lines = pass through resources vehicle to vehicle

Figure 3.1-3 - iLIDS-to-Host Vehicle Interface Diagram

[**R.LIDS.0001**] **iLIDS Structural Attachment on Vehicle**

The iLIDS shall provide structural mating and sealing to the Vehicle per JSC-65795, NDS IDD.

Rationale: The mating vehicle includes CDA. The Vehicle will provide accommodation to allow iLIDS to attach to the vehicle. The iLIDS-to-host vehicle is secured/attached by fasteners. See Figure: iLIDS to Host Vehicle Mounting Interface for a schematic of the mounting interface. The iLIDS will provide the fasteners for this interface. The iLIDS mechanism will be provided as Government Furnished Equipment. Refer to JSC-65795, International Low Impact Docking System (iLIDS) Interface Definition Document (IDD) for the details of this interface. The interface defined is based on the common interface used for Apollo/Soyuz, Shuttle/Mir, and Shuttle/ISS docking systems.

[**R.LIDS.0003**] **Host Electrical Power Interface - 120 Vdc**

The iLIDS (-301, -302) shall operate with host vehicle power of 120 Vdc in accordance with JSC-64599, iLIDS Electric Power Quality Description Document.

Rationale: An electrical power interface is needed to allow the host vehicle to power the iLIDS. This is the power for iLIDS consumption, which is not to be confused with the host vehicle pass-through power to the mating vehicle. Future configurations will allow for other host vehicle power (e.g. 28 Vdc).

[R.LIDS.0004] Reception of Commands for Docking

The iLIDS shall receive commands from the Vehicle for all sequences.

Rationale: The Vehicle can send an individual sequence or chain of sequences. The iLIDS IDD, JSC-65795, will specify the ordering of sequence; however, it is up to the Vehicle's discretion to send them.

[R.LIDS.0006] Docking Termination

The iLIDS shall terminate docking upon receipt of a command from the Vehicle.

Rationale: For safety purposes, automated functions such as docking should be designed with an override capability which allows the human operators to stop, safe, or assume manual control of the automated function after it was initiated. The point at which the override occurs will differ depending on the function. Some activities may only be taken to a safe state and no manual control is available. The intent is to cover the time span beginning with contact and extending through docking completion. This ability is required for the Vehicle crew, ISS crew, or other Space System operators to control automated functions onboard the Vehicle.

[R.LIDS.0007] Undocking Termination

The iLIDS shall terminate undocking upon receipt of a command from the Vehicle.

Rationale: For safety purposes, automated functions such as undocking should be designed with an override capability which allows the human operators to stop, safe, or assume manual control of the automated function after it is initiated. The point at which the override occurs will differ depending on the function. Some activities may only be taken to a safe state and no manual control is available. This ability is required for the Vehicle crew, ISS crew, or other Space System operators to control automated functions onboard the Vehicle.

[R.LIDS.0008] Pause Docking Commands

The iLIDS shall accept a command from the Vehicle to pause the docking sequence during any part of the operation.

Rationale: There are failure scenarios where the docking sequence should not be terminated, but rather paused to allow troubleshooting.

[R.LIDS.0009] Pause Undocking Commands

The iLIDS shall accept a command from the Vehicle to pause the undocking sequence during any part of the operation.

Rationale: There are failure scenarios where the undocking sequence should not be terminated, but rather paused to allow troubleshooting.

[R.LIDS.0010] Validation of Commands

The iLIDS shall validate commands from the Vehicle.

Rationale: The iLIDS will execute commands generated internally or from other systems in order to perform the specified function or operation. This process includes checking if the command has valid data values and if those can be executed, based on the current state or mode. Updates to the corresponding health and status parameters provide the results of the command execution.

[R.LIDS.0011] Command Notification

The iLIDS shall provide a notification for validity of commands to the Vehicle.

Rationale: Command notification includes a response for both valid and invalid commands. Command originators need a response or acknowledgement to understand the status of a command. Vehicle command validation failures, particularly crew initiated commands, warrant near real-time indication of validation failure to the crew, ground, and/or command initiator.

[**R.LIDS.0012**] **Command Processing Latency**

The iLIDS shall have a command processing latency no greater than 35 ms, where the performance measurement is taken from the time the command crosses the Vehicle to iLIDS interface to the time the command executes.

Rationale: An upper bound on command processing latency must be established to drive and manage overall avionics and software system design and end-to-end avionics and software performance. This value is driven by and is the part of the time allocation, allocated to iLIDS, from the max total time (200 ms from JSC-65795, NDS IDD) required for a switch from system A to B to take place in the case of a fault requiring primary control being transferred from system A to B.

[**R.LIDS.0014**] **iLIDS Health and Status During iLIDS Operations**

The iLIDS shall generate and provide health and status information to the Vehicle during iLIDS operations.

Rationale: This includes generic health and status data as well as data from safety and mission critical functions. This requirement meets the intent of SSP 50021, Safety Requirements Document, Section 3.3.6.1.5.2 and SSP 41000, System Specification for the International Space Station, paragraph 3.3.6.4.

[**R.LIDS.0017**] **Communications with the Host Vehicle (EIA-422-B)**

The iLIDS shall communicate with the host vehicle per the electrical characteristics specified in ANSI/TIA/EIA-422-B.

Rationale: This standard provides reliable serial communications. The iLIDS has requirements to be able to communicate in either EIA-422-B or MIL-STD-1553B but not both to a single host vehicle. The host vehicle supplied interfacing connector to iLIDS can only be wired for one of the two communication protocol types.

[**R.LIDS.0018**] **Packet-Driven Command/Response**

The iLIDS shall use a packet-driven command/response structure for data communications.

Rationale: A packet-driven command/response Command and Data Handling (C&DH) system allows for error checking and reliable delivery.

[**R.LIDS.0019**] **Execution of Commands**

The iLIDS shall execute valid commands received from the Vehicle.

Rationale: The iLIDS will execute commands generated from the Vehicle in order to perform the specified function or operation.

[**R.LIDS.0020**] **Status of Execution of Commands**

The iLIDS shall provide execution status of commands to the Vehicle.

Rationale: Command initiators should know the status of Vehicle commands to the iLIDS for monitoring and awareness of the iLIDS state.

[**R.LIDS.0024**] **Transfer of Data and Communications**

The iLIDS to Vehicle umbilical interfaces shall be capable of transferring hard-line MIL-STD-1553 and 10/100 Base T Ethernet data and communications between the mated vehicles.
Rationale: Hard line communication allows command and data handling between the mated vehicles. The formats provided are based on current ISS capability.

[**R.LIDS.0026**] **Bonding**
The iLIDS to Vehicle interface shall meet Class R bonding requirements in accordance with NASA-STD-4003, Electrical Bonding for NASA Launch Vehicles, Spacecraft, Payloads, and Flight Equipment.
Rationale: The mating vehicle includes the CDA. Adherence to approved standards.

[**R.LIDS.0290**] **iLIDS Power and Data Transfer Performance Characteristics**
The iLIDS power and data transfer shall meet the performance characteristics as defined in D684-14211-01, iLIDS FRAM Connector Test Evaluation.
Rationale: The iLIDS electrical power and data transfer between the two docked vehicles is not used by the iLIDS, but only transferred between the docked vehicles. In order to ensure proper vehicle function, any drop in the voltage in iLIDS owned wiring between where one vehicle provides power and the other vehicle receives power needs to be limited. Further data transfer performance characteristics to ensure signal integrity.

[**R.LIDS.1085**] **iLIDS Interface Definition**
The iLIDS interfaces shall meet provisions and descriptions per JSC-65795, NASA Docking System (NDS) Interface Definitions Document (IDD).
Rationale: The iLIDS is NASA's implementation for the emerging International Docking System Standard (IDSS) using low impact docking technology.

[**R.LIDS.1114**] **Leak Rate for iLIDS-to-Vehicle Interface**
The iLIDS-to-Vehicle interface shall have a maximum of 0.0008 lbm dry air/day (0.0004 kg air/day) leakage at vestibule pressurization of 14.7 psia (101 kPa) and an external vacuum pressure when mated.
Rationale: The leakage value is based on room temperature static leakage testing with allowances for expected thermal excursions. See also R.LIDS.0041 and R.LIDS.1113.

[**R.LIDS.1116**] **H&S Data Processing Latency**
The iLIDS shall have a health and status data processing latency no greater than 45 ms, where the performance measurement is taken from the time H&S data is sampled to the time the H&S data crosses the iLIDS to Vehicle interface.
Rationale: An upper bound on H&S data processing latency must be established to drive and manage overall avionics and software system design and end-to-end avionics and software performance. This value is driven by and is the part of the time allocation, allocated to iLIDS, from the max total time (200 ms from NDS IDD) required for a switch from system A to B to take place in the case of a fault requiring primary control being transferred from system A to B. If a fault requiring a switch to the redundant string is identified, there is a minimum amount of time to detect, report to the vehicle, and the vehicle to issue a command to switch between controllers in order to maintain safe

control of the linear actuators, depending on the mode and state of iLIDS. This switch time is most critical during dock mode capture and attenuation states.

[**R.LIDS.1129**] **Communications with the Host Vehicle (MIL-STD-1553B)**
The iLIDS shall communicate with the host vehicle per the electrical characteristics specified in MIL-STD-1553B.
Rationale: This standard provides reliable serial communications. The iLIDS has requirements to be able to communicate in either EIA-422-B or MIL-STD-1553B but not both to a single host vehicle. The host vehicle supplied interfacing connector to iLIDS can only be wired for one of the two communication protocol types.

[**R.LIDS.1130**] **Message Formats with the Host Vehicle (MIL-STD-1553B)**
The iLIDS shall use message formats specified in JSC-65795, NDS IDD for the MIL-STD-1553 communication interface.
Rationale: This document provides the data format and timing required to communicate over t he MIL-STD-1553 data bus.

[**R.LIDS.1131**] **Distinguishing Communications with the Host Vehicle (EIA-422-B vs. MIL-STD-1553B)**
The iLIDS shall determine the host vehicle communication protocol (EIA-422-B or MIL-STD-1553B) by checking for shorted pins on the host vehicle connector.
Rationale: The iLIDS has requirements to be able to communicate in either EIA-422-B or MIL-STD-1553B but not both to a single host vehicle. The host vehicle supplied interfacing connector to iLIDS can only be wired for one of the two communication protocol types. The iLIDS must determine the host vehicle communication type in order to communicate with the vehicle.

[**R.LIDS.1132**] **Duplex Communications with the Host Vehicle (EIA-422-B)**
The iLIDS shall communicate with the host vehicle in full duplex, using differential signaling with two unidirectional, nonreversible point to point terminated transmission lines.
Rationale: This is the iLIDS specific implementation of EIA-422-B.

[**R.LIDS.1133**] **Data Exchange with the Host Vehicle (EIA-422-B)**
The iLIDS shall exchange data with the host vehicle in an asynchronous serial communications format utilizing a Universal Asynchronous Receiver/Transmitter (UART) controller, NRZ (non-return to zero) with one start bit, 8 data bits (LSB first) and one stop bit.
Rationale: This is the iLIDS specific implementation of EIA-422-B.

[**R.LIDS.1134**] **Message Exchange with the Host Vehicle (EIA-422-B)**
The iLIDS shall exchange messages with the host vehicle of a fixed packet length, with a bit rate of 921.6K, and a status update rate of 50Hz.
Rationale: This is the iLIDS specific implementation of EIA-422-B.

3.1.2.2 iLIDS-to-iLIDS Interface

The iLIDS integrated on the Vehicle incorporates the following interfaces when mated to another iLIDS:

- Support structural/mechanical attachment.

- Supports vehicle-to-vehicle transfer of atmosphere, power, data, and communications. Future configurations will include water, fuel, oxidizer, and pressurant.
- Support soft-capture through electromagnets. The iLIDS-to-iLIDS system interface is illustrated in the iLIDS System Interface Diagram.

[**R.LIDS.0030**] **Transfer of Power**

The iLIDS-to-iLIDS umbilical interfaces shall be capable of transferring four 8 American Wire Gauge (AWG) circuits of electrical power (2 per umbilical).

Rationale: The intent of this requirement is to allow for power transference between two mated systems. This is not the power for the iLIDS consumption. The four lines give the host options to transfer redundant feeds of two different voltages. ISS will be capable of transferring both 120 Vdc and 28 Vdc. However, ISS is not expected to transfer both at the same time.

[**R.LIDS.0034**] **Automatic Umbilical Demating**

The iLIDS-to-iLIDS umbilical interface shall automatically demate during undocking operations.

Rationale: The mating vehicle includes the CDA. The umbilicals for power, data, etc. are intended to demate without crew intervention during the undocking sequence. This facilitates emergency undocking scenarios.

[**R.LIDS.0037**] **Soft Capture**

The iLIDS SCS shall meet Class S bonding requirements in accordance with NASA-STD-4003, Electrical Bonding for NASA Launch Vehicles, Spacecraft, Payloads, and Flight Equipment.

Rationale: The SCS adheres to approved standards to provide a controlled resistance path to mitigate hazards caused by potential differences in electrical potential between mating vehicles during contact.

[**R.LIDS.0038**] **Hard Capture**

The iLIDS HCS shall meet Class R bonding requirements in accordance with NASA-STD-4003, Electrical Bonding for NASA Launch Vehicles, Spacecraft, Payloads, and Flight Equipment.

Rationale: (1) to prevent possible circulating currents in interconnected electrical power systems; (2) to mitigate ground-conducted noise that could significantly degrade signal noise margins of intervehicular communications systems; and (3) to ensure a common voltage reference for intervehicular avionics systems connections. This does not apply to umbilicals.

[**R.LIDS.1113**] **Leak Rate for iLIDS-to-iLIDS Interface**

The iLIDS-to-iLIDS interface shall have a maximum of 0.0025 lbm dry air/day (0.0011 kg air/day) leakage at vestibule pressurization of 14.7 psia (101 kPa) and an external vacuum pressure when mated.

Rationale: The leakage value assumes 12 hard capture system hooks fully engaged and derives from a nominal ISS trajectory and exposure to 1E21 atoms/cm2 atomic oxygen and 214 equivalent Sun hours (TBR-212) ultraviolet radiation (for a duration of up to 21 days). The atomic oxygen exposure includes both pre-treatment of the seals *and on-orbit exposure at 4.4 x 10E19 oxygen atoms/cm2 per day. See also R.LIDS.0041 and R.LIDS.1114.*

[**R.LIDS.0041**] **Leak Rates for iLIDS feed throughs when Mated**
The iLIDS (excluding -302) feed throughs internal to iLIDS shall have a maximum of 0.0007 lbm dry air/day (0.0003 kg air/day) leakage at vestibule pressurization of 14.7 psia (101 kPa) and an external vacuum pressure when mated.
Rationale: The leakage value is based on 14 class 77H hermetic feed throughs (8X size 25 connectors, 6X size 13 connectors). See also R.LIDS.1113 and R.LIDS.1114.

[**R.LIDS.1004**] **Hook Compliance**
The iLIDS shall implement compliance on the passive hook of the mating active-passive hook pair.
Rationale: To successfully structurally mate with another docking system, it is necessary to specify where the compliance is located in the active/passive hook pairing.

[**R.LIDS.1005**] **Guide Pins and Receptacles**
The iLIDS shall provide guide pin/receptacle for tangential constraint and alignment of the systems during hard mate per JSC-65795, NDS IDD.
Rationale: Guide pin/receptacles provide fine alignment during soft capture system retraction and restrict rotation and shear of the systems while mated.

[**R.LIDS.1006**] **Seal on Seal Mating Interface**
The iLIDS (excluding -302) shall implement a mating seal interface per JSC-65795, NDS IDD for surface specification.
Rationale: The docking system must include a seal interface to support pressurization after structural mate. The seals meet the emerging IDSS and support either seal on seal or seal on metal operation.

[**R.LIDS.1007**] **Seal on Metal Mating Interface**
The iLIDS (-302) shall implement a metallic sealing surface per JSC-65795, NDS IDD for surface specification
Rationale: Although the iLIDS is designed for seal on seal mated operations, the iLIDS for ISS will have a metallic sealing surface which will be more durable for the longer life of the ISS hardware.

[**R.LIDS.1020**] **Soft Capture Latch: Passive Mechanical**
The iLIDS shall include scaring to support future implementation of a mechanical soft capture latch strike as defined in JSC-65795, NDS IDD for surface specification.
Rationale: The emerging IDSS allows for both magnetic and mechanical capture. The NASA implementation is magnets but may be modified in the future to allow an IDSS compatible docking system with mechanical soft capture latches to dock. The scarring will maintain a Keep Out Zone to allow implementation of the striker shown in the figure. Further, the scarring will include a bolt pattern sized to accept soft capture loads applied at the tip of the mechanical striker.

[**R.LIDS.1037**] **Umbilical Connector Mate Indication**
The iLIDS shall provide loop back circuits for the host to verify connector mating on power and data umbilical connectors.

Rationale: This allows confirmation prior to power and data transfer that mating is successful.

[**R.LIDS.1094**] **iLIDS Automatic/Manual Sequencing**
The iLIDS shall provide the capability to operate sequences either automatically or manually via software control.
Rationale: Such operation allows the user to initiate sequences automatically or to manually step through the sequences. The iLIDS default is automatic sequencing.

[**R.LIDS.1095**] **iLIDS Active Dock Mode**
The iLIDS shall provide an Active Dock mode of operations.
Rationale: The Active Docking mode includes the entire docking sequence and all related flags as well as health and status data.

[**R.LIDS.1096**] **iLIDS Active Undock Mode**
The iLIDS shall provide an Active Undock mode of operations.
Rationale: The Active Undocking mode includes the entire undocking sequence and all related flags as well as health and status data.

[**R.LIDS.1097**] **iLIDS Passive Dock Mode**
The iLIDS shall provide a Passive Dock mode of operations.
Rationale: During the Passive Dock mode, the iLIDS will provide all health and status data as well as flags for soft capture. In addition, all outputs will be inhibited during operation (e.g. motors, magnets, etc.).

[**R.LIDS.1098**] **iLIDS Passive Undock Mode**
The iLIDS shall provide a Passive Undock mode of operations.
Rationale: During the Passive Undock mode, the iLIDS will provide all health and status data as well as flags for undocking completion. In addition, all outputs will be inhibited during operation (e.g. motors, magnets, etc.).

[**R.LIDS.1099**] **iLIDS Safe Mode**
The iLIDS shall provide a Safe mode of operations.
Rationale: During the Safe mode, the iLIDS will provide all health and status data. In addition, all outputs will be inhibited during operation (e.g. motors, magnets, etc.).

[**R.LIDS.1100**] **iLIDS Check-out Mode**
The iLIDS shall provide a Check-out mode of operations.
Rationale: The Check-out mode detects damage and errors in iLIDS by exercising the iLIDS mechanisms through a pre-determined sequence.

[**R.LIDS.1101**] **iLIDS Engineering Mode**
The iLIDS shall provide an Engineering mode of operations.
Rationale: The Engineering mode supports troubleshooting without the constraints of all other modes. For example, the Engineering mode will allow the user to command a single motor on/off. It is critical to adhere to proper procedures during this mode.

[**R.LIDS.1112**] **Umbilical Auto-Mate**
The iLIDS shall automatically mate umbilical connectors within 15 minutes of achieving hard mate.
Rationale: Umbilical connector mate is critical function for resource transfer. It is necessary to perform this action without EVA/IVA activity.

[**R.LIDS.1124**] **iLIDS Active Hook Profile**
The iLIDS shall provide active hooks as defined in JSC-65795, NDS IDD.
Rationale: The iLIDS, when mated, has 24 attachment points where 12 active hooks on one system engage 12 passive hooks on the mating system to carry nominal loads. The hook profile allows mating with the emerging IDSS.

[**R.LIDS.1125**] **iLIDS Passive Hook Profile**
The iLIDS shall provide passive hooks as defined in JSC-65795, NDS IDD.
Rationale: The iLIDS, when mated, has 24 attachment points where 12 active hooks on one system engage 12 passive hooks on the mating system to carry nominal loads. The hook profile allows mating with the emerging IDSS.

3.1.2.4 iLIDS-to-EVA Interface

The iLIDS-to-Extravehicular Activity (EVA) interface only includes translation around the exterior of the iLIDS while docked. If EVA occurs while undocked, the docking surfaces (i.e. "face") of the iLIDS tunnel is an EVA Keep-out Zone (KOZ) in addition to the interior of the tunnel. Refer to JSC-65795, NDS IDD for EVA KOZ.

[**R.LIDS.0045**] **Contamination**
The iLIDS hardware in the EVA translation path shall meet a generally clean level as identified by JPR 5322.1, Contamination Control Requirements, or higher, for interface with the Extravehicular Mobility Unit (EMU).
Rationale: This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 4.2.

[**R.LIDS.0046**] **EVA Sharp Edges**
Any iLIDS hardware accessible to the EVA crew shall meet the edge, corner, and protrusion requirements in Table 3.1, Figure 3-1, and Table 3-2 of JSC-28918, EVA Design Requirements and Considerations. This requirement applies to hardware within 24" of an adjacent EVA worksite.
Rationale: These edge, corner, and protrusion requirements were originally developed to prevent the cutting of the EMU glove. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.11.

[**R.LIDS.0047**] **EVA Thin Material Edge Radii**
Any iLIDS materials less than 0.08-in. (2.032-mm) thick that are used in a location accessible to EVA, edge radii shall be greater than 0.003-in. (0.0762-mm).
Rationale: These edge and corner requirements were originally developed to prevent the cutting of the EMU glove. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.11.2 and modified to represent the correct conversion factor.

[**R.LIDS.0048**] **EVA Thin Material Spacing**
Any iLIDS materials less than 0.08-in. (2.032-mm) thick that are used in a location accessible to EVA, shall have edges uniformly spaced, not to exceed 0.5-in. (1.27-cm) gaps, flush at the exposed surface plane and shielded from direct EVA interaction.
Rationale: These edge and corner requirements were originally developed to prevent cutting of the EMU glove. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.11.2.

[R.LIDS.0050] Burrs

Any iLIDS exposed surfaces accessible to EVA crew shall be smooth and free of burrs.
Rationale: Burrs are potential sharp edges and, therefore, can possibly cause an EVA suit catastrophic leakage. This is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.15.

[R.LIDS.0051] Screws and Bolts

Any iLIDS hardware shall include protective features on screws or bolts in established worksites (planned and contingency) and translation routes to prevent snagging, and to protect against sharp edges and impact.
Rationale: Snagging of the EVA suit or umbilicals could cause a tear, resulting in suit catastrophic leakages. Additionally, sharp-edge cuts and impact punctures could cause suit catastrophic leakages. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.13.

[R.LIDS.0052] Hardware Protrusion

The iLIDS hardware shall be free of hardware protruding into the translation corridor as shown in Figure 4-6 of JSC-28918, EVA Design Requirements and Considerations, except for translation aids.
Rationale: Protrusions into the translation path are potential snag points (suit and umbilical tear hazard) and EVA suit impact hazards (puncture hazard). The 109-cm (43-in.) diameter translation path is based upon the EMU, which is a Space Transportation System (STS)/ISS legacy and derives from JSC-28918, EVA Design Requirements and Considerations, Paragraph 4.20.1.1. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.17.

[R.LIDS.0054] Entrapment Hazard - Snagging

Any iLIDS hardware that is EVA-accessible shall preclude snagging an EVA crewmember, umbilical, or a limb/tether, such that the EVA crew could not be removed.
Rationale: Inability to free an entrapped EVA crewmember is a catastrophic hazard. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.19.1.

[R.LIDS.0055] Pinch Points

The iLIDS shall ensure that hardware located within translation paths and established worksites (planned and contingency) that is EVA-accessible does not have pinch hazards.
Rationale: This applies to, but is not limited to, hardware that pivots, retracts, flexes, or has a configuration such that a gap of greater than 0.5 in. (12.7 mm), but less than 1.4 in. (3.556 cm) (glove pinching), exists between the equipment and adjacent structure. Any item that has a potential to pinch any appendage, including legs or other body parts, will also be designed out or protected against, either by using a keep-out zone for areas outside a translation path or worksite or by using a physical barrier. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.18

[R.LIDS.0056] Entrapment Hazard - Trapping

Any iLIDS hardware that is EVA-accessible shall preclude trapping an EVA crewmember, umbilical, or a limb/tether, such that the EVA crew could not be removed.
Rationale: Inability to free an entrapped EVA crewmember is a catastrophic hazard. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.19.1.

[**R.LIDS.0057**] **Exposed Circular Holes**
Any exposed circular holes on iLIDS accessible to EVA crew shall be less than 0.5 in. (1.27 cm) in diameter or greater than 1.4 in. (3.556 cm) in diameter to prevent entrapment of an EVA suit-gloved finger.
Rationale: Entrapment of the EVA crewmember or damage to the EVA suit, and possible suit leakage, while freeing the entrapped appendage is considered a catastrophic hazard. Holes that are irregularly shaped will be evaluated individually as a part of the safety process. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.16.

[**R.LIDS.0058**] **EVA Induced Loads**
Any iLIDS hardware within the EVA translation corridor as shown in Figure 4-6 or adjacent EVA worksite as defined in Figure 4-15 of JSC-28918 shall meet the requirements for Inadvertent Kick Loads as defined in JSC-28918, EVA Design Requirements and Considerations, Table 4.7, EVA-Induced Loads.
Rationale: EVA can induce significant loads into surrounding hardware and structure. These loads were compiled over several years of EVA with legacy EMU hardware. Meeting this requirement means that the hardware, when exposed to EVA crew-induced loads, shall not a) create a hazardous condition, b) suffer loss of structural integrity, or c) suffer a loss of functionality. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 4.9.

[**R.LIDS.0060**] **EVA Touch Temperature Limits**
The iLIDS hardware that interfaces with the EVA glove palm shall be in accordance with Table 4.4 of JSC-28918, EVA Design Requirements and Considerations.
Rationale: iLIDS will provide input into the integrated thermal analysis. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 4.4.4. These limits do not apply to the backside of the glove and the EMU thermal meteoroid garment (TMG) orthofabric that have different standards set out in Section 4.4.5.

[**R.LIDS.0061**] **DC Magnetic Field**
The iLIDS shall preclude emitting Direct Current (DC) magnetic fields in excess of 250 Gauss during EVA translation across iLIDS.
Rationale: This requirement will preclude interference with the EVA suit electronics/electrical systems and EVA tool electrical assemblies. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.5.3.

[**R.LIDS.1119**] **iLIDS Hazardous Energy Provision**
iLIDS shall design or use components that retain hazardous energy, either with design features that prevent releasing the stored energy in any manner that could pose a

hazard to the EV crewmember or with provisions to allow safing of the potential energy, including provisions to confirm that the safing was successful.
Rationale: This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 3.7.

[**R.LIDS.1121**] **EMU TMG Orthofabric and Glove Back External Touch-Temperature Compliance**
iLIDS shall demonstrate compliance with EMU Thermal/Micrometeoroid Garment (TMG) orthofabric limitations that include the backside of the EMU glove for crew protection from damage to the EMU TMG.
Rationale: This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 4.4.5.

[**R.LIDS.1122**] **EMU TMG Orthofabric and Glove Back External Touch-Incidental Contact**
iLIDS EVA surfaces that can be touched shall be within a range of 244 °F to 320 °F (153 °C to 160 °C).
Rationale: This is to demonstrate compliance with EMU TMG orthofabric limitations for external portions of hardware that can be inadvertently touched by brushing or bumping in EVA operations. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 4.4.5.1.

[**R.LIDS.1123**] **EMU TMG Orthofabric and Glove Back External Touch-Extended Contact**
iLIDS shall design EVA hardware surfaces requiring prolonged compression of the EMU TMG orthofabric to remain within a range of 195 °F to +240 °F (126 °C to 116 °C) during extended contact operations.
Rationale: In rare cases, EVA operations and/or hardware design require long-duration compression of the TMG orthofabric, thereby thermally shorting the multilayer insulation and making TMG layers vulnerable to thermal damage. This requirement is in accordance with JSC-28918, EVA Design Requirements and Considerations, Section 4.4.5.2.

3.2 Characteristics

3.2.1 Functional Performance

3.2.1.1 Docking

[**R.LIDS.0063**] **Docking Envelope**
The iLIDS shall be capable of docking when the vehicle misalignments and relative motions are within the parameters as specified by the iLIDS Initial Contact Conditions "Design To" Limits table.

Table 3.2-1 - iLIDS Initial Contact Conditions “Design To” Limits(1)(2)(3)(4)

Initial Conditions	Limiting Value
Closing (axial) rate	0.05 to 0.15 ft/s (0.015 to 0.045 m/s)
Lateral (radial) rate	0.15 ft/sec(4) (0.045 m/s)
Angular rate	0.15 deg/sec about iLIDS Z axis, Vector sum of 0.15 deg/sec about iLIDS X and Y axis

Lateral (radial) misalignment	4.2 inches (106 mm)
Angular misalignment	4.0 deg about iLIDS' Z axis; vector sum of 4.0 deg about iLIDS X and Y axis

Notes:

(1) Initial conditions to be applied simultaneously.

(2) The iLIDS will us a right-hand orthogonal body coordinate system, the origin of which lies in the intersection of the iLIDS cylindrical center line Z-axis and HCS Mating Plane.

(3) These initial conditions are applicable for the docking of a chaser host vehicle with a mass of at least 1000 slugs (15000 kg), but no greater than 1700 slugs (25000 kg), to a target vehicle with a mass of at least 24000 slugs (350000 kg).

(4) Lateral (radial) rate limit includes combined lateral and rotational rates of both vehicles.

Rationale: Table iLIDS Initial Contact Conditions "Design To" Limits includes high-level information on capture envelope data.

[**R.LIDS.0064**] **Initial Contact Signal**

The iLIDS shall provide a signal indication of initial contact.

Rationale: This indication is required by the Vehicle to perform attitude and translational system moding during capture operations.

[**R.LIDS.0065**] **Soft Capture**

The iLIDS shall perform soft capture during docking operations.

Rationale: Soft capture is the initial physical connection prior to final structural mating.

[**R.LIDS.0066**] **Soft-Capture Signal Indication**

The iLIDS shall provide a signal indication of soft capture during docking operations.

Rationale: This indication allows the Vehicle to initiate proper moding.

[**R.LIDS.0069**] **Attenuation**

The iLIDS shall attenuate relative motion between the two mating vehicles, subject to the mass properties, load constraints, and contact conditions specified in JSC-65970, iLIDS Thermal and Induced Environments (iLIDS TIES), during docking operations.

Rationale: JSC-65970, iLIDS Thermal and Induced Environments (iLIDS TIES), includes load attenuations and mass properties, among other properties.

[**R.LIDS.0071**] **Hard-Capture Signal Indication**

The iLIDS shall provide a signal indication of hard capture during docking operations.

Rationale: Hard capture signal indication indicates structural mating.

[**R.LIDS.0073**] **Docking Time During Free Drift**

The iLIDS shall require no more than 20 minutes of free drift once docking has been initiated.

Rationale: When the Vehicle is in free drift, the time needs to be limited to 20 minutes to preclude vehicle problems, such as solar arrays pointing away from the Sun. Free drift starts upon initial contact of the load cell and ends with latches engaging.

3.2.1.2 Undocking

[**R.LIDS.0075**] **Undocking Time**

The iLIDS shall be capable of undocking within 10 minutes when iLIDS undocking sequence is initiated.

Rationale: The requirement implies that all nominal systems are required to be operational within this time, including Guidance, Navigation, and Control (GN&C) parameters. The undocking sequence begins with the hatch secured and the crew's initiation of the iLIDS undocking sequence.

[**R.LIDS.0076**] **Indication of Physical Separation**

The iLIDS shall provide a signal indication of physical separation during undocking operations.

Rationale: This indication is required by the Vehicle to perform attitude and translational system moding during undocking operations.

[**R.LIDS.0079**] **Adjustability of iLIDS Performance Parameters**

The iLIDS shall accept software reconfiguration, via commands, of soft capture system controller performance parameters to accommodate capture/attenuation of various mass vehicles within the load set defined in JSC-65970, iLIDS Thermal and Induced Environments (iLIDS TIES).

Rationale: This requirement will allow iLIDS reconfiguration (through software parameters or mode settings). For example, iLIDS can be reconfigured to make the six degree of freedom (6DOF) platform load reaction stiffer for a particular mission or docking scenario.

[**R.LIDS.1042**] **Pyrotechnic Initiation**

The iLIDS (excluding -302) shall use NASA Standard Initiators (NSI's) for pyrotechnic devices.

Rationale: Pyrotechnic provides additional fault tolerance for undocking hazards. iLIDS pyrotechnics are safety-critical because their inadvertent operation results in a catastrophic hazard. Use of proven NSI design ensures safe and reliable pyrotechnic design and operation. This requirement is in accordance with SSP 50021, Safety Requirements Document, Section 3.3.6.5.1.1. The -302 is intended for use on ISS and has been decided to not include pyros so that the port cannot be fouled by firing pyros and disabling hooks for future docking.

[**R.LIDS.1069**] **Separation System**

The iLIDS shall provide a separation system capable of providing demate work (energy) between 28.9 ft-lbs (4.0 kgf-m) and 31.1 ft-lbs (4.3 kgf-m) after umbilical and seal demating.

Rationale: Docking systems historically have provided a means to accelerate the vehicle away when the structural mate mechanism is released. The system must be capable of demating connectors and overcoming seal stiction in addition to providing the demating energy.

[**R.LIDS.1115**] **Pyrotechnic Release**

The iLIDS (excluding -302) shall provide pyrotechnics in both the active and passive hooks at the hard mate interface.

Rationale: If the iLIDS active hooks fail to unlatch, the host may fire the pyrotechnics releasing all 24 hooks within TBD-40 milliseconds allowing the host to separate from the mated vehicle

3.2.2 Physical

[R.LIDS.0082] iLIDS Pass-Through Diameter

With SCS guide petals removed, the iLIDS shall provide an unobstructed 32-in. minimum diameter passage for pressurized transfer of crew and cargo with no permanent protrusions, drag-through cables, or obstruction, excluding the inter-module ventilation air duct.

Rationale: Pressurized transfer of cargo and unsuited crew, etc. is the primary purpose of docking the Vehicle. SSP 50005, Section 8.8.3.1 requires a minimum pass-through diameter of 32" be available for translation paths.

3.2.2.1 Mass

[R.LIDS.0080] iLIDS (-301) Mass

The iLIDS (-301) shall mass shall not exceed 750 lbm (340.91 kg).

Rationale: This is the mass with Mass Growth Allowance (MGA).

[R.LIDS.1056] iLIDS (-302) Mass

The iLIDS (-302) shall mass shall not exceed TBD-2 lbm.

Rationale: This is the mass with Mass Growth Allowance (MGA).

3.2.2.2 Dimensions/Volume

Dimensions and volume are defined in JSC-65795, NDS IDD. iLIDS will meet all IDD definitions as defined by [R.LIDS.1085].

[R.LIDS.0000] iLIDS Physical Envelope

The iLIDS (excluding -302) shall fit in a cylindrical envelope of 68 in. diameter by 22 in. height.

Rationale: The height described here is the stowed height measured from the host interface mounting flange to the tip of the soft capture system guide petals.

[R.LIDS.1072] iLIDS (-302) Physical Envelope

The iLIDS (-302) shall fit in a cylindrical envelope of 68 in. diameter by 16 in. height.

Rationale: The height described here is the pre-integrated CDA height.

3.2.3 Environmental

[R.LIDS.0027] iLIDS Thermal and Induced Environments

The iLIDS will meet all of its functional and performance requirements during and after exposure to the loads defined in JSC-65970, iLIDS Thermal and Induced Environments (iLIDS TIES).

Rationale: iLIDS will meet the loads defined in the JSC-65970, iLIDS TIES. JSC-65970 contains loads for launch, in-flight, docking/berthing, structural limits, and postcapture, thermal, among others. JSC-65970 will specify which loads are function during and/or after versus survival only.

[R.LIDS.0093] Exposure to Induced Environments

The iLIDS shall meet all its functional and performance requirements during and after exposure to the induced environmental conditions as defined in SSP 41000, System Specification for the International Space Station, Section 3.2.6.

Rationale: Induced environments can degrade system performance, shorten system life, and lead to system or mission failure if not properly considered in the design.

[**R.LIDS.0104**] **Environmental Qualification and Acceptance Testing**
iLIDS shall comply with SSP 41172, Qualification and Acceptance Environmental Test Requirements, for environmental certification testing.
Rationale: The SSP 41172 standard contains both qualification and acceptance testing requirements for natural and induced environments as well as minimum design screening requirements that are beyond the expected environments. As with other design and construction standards, SSP 41172 will drive the design because the design must take into account that it will need to encompass a larger range of environments or minimum screening environments, whichever is greater, as part of the equipment's certification program. Vehicle spacecraft equipment is required to meet specific requirements through qualification testing to Maximum Predicted Environments (MPE) with sufficient margin, durations, and workmanship standards. Qualification testing demonstrates the design, manufacturing process, and acceptance program produce hardware/software that meet specification requirements with adequate tolerance.

3.2.3.1 Thermal

[**R.LIDS.0091**] **Automatic Safing with Manual Override for Temperature Control**
iLIDS heaters shall allow for individual zones to be commanded on and off by the host vehicle in order for the host vehicle to provide manual override control.
Rationale: This requirement supports the host vehicle capability to comply with JPR 8080.5 standard G-16

[**R.LIDS.1051**] **Active Thermal System Control**
The iLIDS shall provide heater control for the docking system, which has controllable set points from the host as provided in the iLIDS Controllable Thermal Interface table.

Table 3.2-2 - iLIDS Controllable Thermal Interface

Scenario	**Temperature Range**
Survival	-58 °F to +192 °F (-50 °C to +89 °C)
Operational	-38 °F to +122 °F (-39 °C to +50 °C)
Mated and Pressurized	Min* °F to +113 °F (min °C to +45 °C)

*The minimum temperature may be specified by the host vehicle and the docking system set point will be adjusted accordingly. The docking system assumes the host vehicle minimum temperature is set above the dew point.

Rationale: Requiring the docking system to control its own heaters simplifies the electrical interface to the host. Control set points allow for different hosts to set minimum temperature to correspond to host dew point requirements. The docking system will define operational and survivability constraints. Based on these constraints, the docking system will implement blankets and/or heaters as required. This requirement also fulfills JPR 8080.5 G-16.

3.2.3.2 Pressure

[**R.LIDS.0101**] **Differential Pressure Limits**
The iLIDS shall function during and after exposure to the pressure differential of 15.95 psia (1100 hPa).

Rationale: iLIDS must survive specified pressurized environments to ensure operations during design reference missions throughout its life. This is also in accordance with JPR 8080.5, Standard MS-1, "Equipment containers or enclosures for use within pressurized compartments of spacecraft shall be designed to withstand rapid decompression of the spacecraft without yielding, fracturing, or sustaining damage."

[**R.LIDS.0102**] **Maximum Design Pressure**
iLIDS shall meet functional and performance requirements during and after exposure to a Maximum Design Pressure (MDP) of 15.55 psid.
Rationale: This provides a test and design-to number for the Vehicle CM pressure vessel. The Vehicle will maintain the internal-to-external pressure less than the MDP, including transient pressure excursions. Also, the ISS is an already designed and operational system. During mated operations, iLIDS must be designed to withstand the ISS peak internal pressure of 15.2 psia with the ISS and Vehicle hatches opened and the Vehicle peak internal pressure of 15.55 psia with the ISS hatch closed.

[**R.LIDS.0103**] **iLIDS Depress Rate**
iLIDS shall survive a 0.76 psi/sec (5.24 KPa/sec) depressurization rate over the range of 15.2 psia (104.8 KPa) to 5.5E-12 psia (2.7E-10 Torr) without loss of functionality as specified herein.
Rationale: iLIDS must survive all specified natural and induced pressure to ensure operations during design reference missions throughout its life. This is also in accordance with JPR 8080.5, Standard MS-1. The 0.76 psi/sec is the same value in SSP 41004, Common Berthing Mechanism to Pressurized Elements Interface Control Document (ICD).

[**R.LIDS.1118**] **iLIDS Repress Rate**
iLIDS shall survive a 0.30 psi/sec (2.07 KPa/sec) repressurization rate over the range of 5.5E-12 psia (2.7E-10 Torr) to 15.2 psia (104.8 KPa) without loss of functionality as specified herein.
Rationale: iLIDS must survive all specified natural and induced pressure to ensure operations during design reference missions throughout its life. This is also in accordance with JPR 8080.5, Standard MS-1. The 0.30 psi/sec is the same value in SSP 41004, Common Berthing Mechanism to Pressurized Elements Interface Control Document (ICD).

3.2.3.3 Vibration

The iLIDS acceleration requirements are decomposed in [R.LIDS.0027] by meeting all functional and performance requirements during and after exposure to the loads defined in JSC-65970, iLIDS Thermal and Induced Environments (iLIDS TIES).

3.2.3.4 Acceleration

The iLIDS acceleration requirements are decomposed in [R.LIDS.0027] by meeting all functional and performance requirements during and after exposure to the loads defined in JSC-65970, iLIDS Thermal and Induced Environments (iLIDS TIES).

3.2.3.5 Shock

The iLIDS acceleration requirements are decomposed in [R.LIDS.0027] by meeting all functional and performance requirements during and after exposure to the loads defined in JSC-65970, iLIDS Thermal and Induced Environments (iLIDS TIES).

3.2.3.6 Electromagnetic Interference/Electromagnetic Compatibility

[**R.LIDS.0100**] **Electromagnetic Interference/Electromagnetic Compatibility (EMI/EMC)**

The iLIDS will be designed to meet requirements in JSC-65842, iLIDS Electromagnetic Environmental Effects (E3) Requirements.

Rationale: This requirement adheres to approved standards.

3.2.3.7 Humidity

[**R.LIDS.1077**] **Humidity Limits**

The iLIDS shall meet specified performance following exposure 0 to 75 percent relative humidity during ground stowage and processing operations.

Rationale: Docking systems have historically been processed in control environments. Refer to the launch site values for humidity in NSTS 07700 Vol. X, Space Shuttle Flight and Ground System Specification Book 2, Environment Design, Weight, and Performance, and Avionics Events Table 6 and Figure 2.

3.2.3.8 Acoustic Emissions

[**R.LIDS.1074**] **Acoustic Emission Limits**

iLIDS shall limit acoustic emissions to the limits as defined in SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Section 5.4.

Rationale: This is in accordance with approved standards. Acoustic limits are only applicable to a crewed vehicle condition with hatches closed. iLIDS is not a source of acoustic noise when docked and unpowered.

3.2.3.9 Meteoroids and Orbital Debris

[**R.LIDS.0295**] **iLIDS MMOD - Short Duration**

The iLIDS (excluding -302) shall provide a probability of no penetration (PNP) of 0.999983 or greater during 210 days docked with the ISS when exposed to the micrometeoroid and orbital debris (MMOD) environments as defined in NASA/TP-2002-210780 for orbital debris and SSP 30425, Space Station Program Natural Environment Definition for Design for meteoroids.

Rationale: The system will be exposed to a variety of natural and induced environments that may pose a threat to functionality and performance, and therefore must be taken into account in the design. The PNP is based on the exposed surface area of iLIDS with 210 days of exposure while docked at the ISS. The surface area assumes standoff shielding on the iLIDS outer diameter. Penetration is defined as a through-hole in the pressure shell or detached spall from the inside surface of the pressure shell such that hazardous debris is generated within the pressurized volume. This requirement also fulfills JPR 8080.5, M/S-11. This requirement does not account for failures resulting from MMOD strikes on other components or during unmated operations. These failure probabilities will be presented as technical risks and *accounted for in hazard reports. The -302 has a longer life and therefore a different PNP number.*

[**R.LIDS.1111**] **iLIDS MMOD - Long Duration**
The iLIDS (-302) shall provide a probability of no penetration (PNP) of 0.99967 or greater during 15 yrs of exposure in the docked configuration on the ISS to the micrometeoroid and orbital debris (MMOD) environments as defined in NASA/TP-2002-210780 for orbital debris and SSP 30425, Space Station Program Natural Environment Definition for Design for meteoroids. Compliance with this requirement will be accomplished at the integrated system level with the host Vehicle.
Rationale: The system will be exposed to a variety of natural and induced environments that may pose a threat to functionality and performance, and therefore must be taken into account in the design. The PNP is based on the exposed surface area of the iLIDS-302 when visiting vehicles are docked at the ISS during the 15 years. The surface area assumes standoff shielding on the iLIDS outer diameter. Penetration is defined as a through-hole in the pressure shell or detached spall from the inside surface of the pressure shell such that hazardous debris is generated within the pressurized volume. This requirement does not account for failures resulting from MMOD strikes on other components or during unmated operations. These failure probabilities will be presented as technical risks and accounted for in hazard reports. The iLIDS (-302) configuration does not include a complete MMOD shield; the integrated shielding will be worked at the integrated system level in order to optimize the configuration for cable routing and installation. This requirement also fulfills JPR 8080.5, M/S-11.

3.2.3.10 Atomic Oxygen

[**R.LIDS.1088**] **Atomic Oxygen**
The iLIDS shall withstand the nominal ram Atomic Oxygen (AO) fluence of 5.0 x 10E21 oxygen atoms/cm2 per year to exposed ram surfaces for missions.
Rationale: The AO environment is applicable to iLIDS internal surfaces and equipment exposed to the external AO environment in the absence of a docked vehicle. The maximum short term: 4.4 x 10E19 oxygen atoms/cm2 per day for 30 days or less. Values are derived from the natural environment definition given in SSP 30425, Space Station Program Natural Environment Definition for Design.

3.2.3.11 External Contamination

[**R.LIDS.0096**] **External Contamination**
The iLIDS shall meet specified performance requirements when exposed to the external contamination environments in accordance with SSP 30426, Space Station External Contamination Control Requirements.
Rationale: The requirements here must show that iLIDS (e.g., seals and other nonmetallic materials) will continue to function when exposed to external contamination.

3.2.3.12 Ionizing Radiation

[**R.LIDS.0183**] **Ionizing Radiation**
The iLIDS shall meet specified performance requirements when exposed to the radiation dose environment in accordance with JSC-64598, iLIDS Ionizing Radiation Control Plan.

Rationale: iLIDS must meet ionizing radiation requirements. This document establishes the ionizing radiation design susceptibility environment for low earth orbit and lunar environments.

3.2.3.13 Lightning

The host vehicle protects iLIDS from primary lightning effects (i.e. lightning direct current path) and limits secondary effects to within the iLIDS Safe Operation Level documented in JSC-65795, NDS IDD.

3.2.3.14 Fungus

[**R.LIDS.1136**] **Fungus**
The iLIDS shall incorporate the use of materials which are non-nutrient to fungi.
Rationale: Prevention of fungus growth is crucial to health and safety of crew and ground processing personnel as well to avoid FOD. When fungus-nutrient materials must be used, they will be sealed or treated to prevent fungus growth.

3.2.4 Reliability

[**R.LIDS.0113**] **Failure Modes and Effects Analysis/Critical Item List**
A Failure Modes and Effects Analysis (FMEA) shall be performed on each level of iLIDS assembly for each required environmental condition and for each operational and abort mode per SSP 30234, Instructions for Preparation of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL) for Space Station.
Rationale: This requirement adheres to approved standards

3.2.4.1 Failure Tolerance

[**R.LIDS.0106**] **Catastrophic Hazard Fault Tolerance**
The iLIDS shall be designed such that no combination of two failures, or two operator errors, or one of each can result in a disabling or fatal personnel injury, or loss of the ISS, unless controlled by DFMR. Compliance with this requirement may be accomplished at the iLIDS level or through a combination of hazard controls at the integrated VV and/or ISS levels.
Rationale: Compliance with ISS program safety requirements. Verification of this requirement may be satisfied via a combination of hazard controls at the iLIDS level and at the integrated system level (including both the VV and ISS). In areas where iLIDS cannot meet this requirement alone, the required integrated hazard controls will be documented as an interface requirement in the appropriate ICD/IDD and the hazard reports will reference those requirements as appropriate. Personnel considered include all flight and ground crews.

[**R.LIDS.0107**] **Critical Hazard Fault Tolerance**
The iLIDS shall be designed such that no single failure or single operator error can result in a non-disabling personnel injury, severe occupational illness; loss of a major ISS element on-orbit life sustaining function or emergency system, unless controlled by DFMR. Compliance with this requirement may be accomplished at the iLIDS level or through a combination of hazard controls at the integrated VV and/or ISS levels.
Rationale: Compliance with ISS program safety requirements. Verification of this requirement may be satisfied via a combination of hazard controls at the iLIDS level and at the integrated system level (including both the VV and ISS). In areas where iLIDS

cannot meet this requirement alone, the required integrated hazard controls will be documented as an interface requirement in the appropriate ICD/IDD and the hazard reports will reference those requirements as appropriate. Personnel considered include all flight and ground crews.

[**R.LIDS.1107**] **Failure Tolerance**

The iLIDS failure tolerances shall meet or exceed the allocations in the Failure Tolerance Allocation table for the identified functions.

Table 3.2-3 - Failure Tolerance Allocation

End Item Function	Failure Tolerance Allocation (A) (B) (C) (E) (F) (G)	
	iLIDS (-301)	iLIDS (-302)
Unlatch hard capture hooks	2	1
Achieve soft capture during docking	1	1
Achieve hard capture during docking	1	1
Hold cabin pressure while docked	1 (D, G)	1 (D,G)
Charge separator springs	1	1
Pass power and data between docked vehicles	1	1
Provide heater power	1	1
Provide temperature sensing	1	1
Provide MMOD protection	0	0

Notes:
(A) Maintenance may not be considered as a redundant path to meet these requirements.
(B) Redundancy used to achieve failure tolerance may be similar or dissimilar.
(C) Failure tolerance defined by requirements in R.LIDS.0106 and R.LIDS.0107.
(D) Degraded performance allowed after one hook failure.
(E) When the iLIDS functions are implemented using structure, the structure shall be exempted from failure tolerance requirements.
(F) When the iLIDS functions are implemented via mechanisms, the mechanisms will be designed for minimum risk and considered to be single failure tolerant equivalent.
(G) One fault tolerance on iLIDS is implemented via dual seals.

Rationale: Fault tolerance improves safety and likelihood of mission success for missions involving iLIDS. The levels of fault tolerance established are reflective of the design that resulted from mass and risk trades performed in the development of iLIDS for the Constellation program, as subsequently further tailored for the ISS program.

3.2.4.2 Failure Propagation

[**R.LIDS.0108**] **Failure Propagation**

A single failure of the iLIDS shall preclude propagation of additional failures external to the failed end item.

Rationale: This is a NASA standard reliability requirement.

3.2.4.3 Failure Detection, Isolation, and Recovery (FDIR)

[**R.LIDS.0109**] **Failure Detection, Isolation, and Recovery (FDIR)**

The iLIDS shall provide Fault Detection, Isolation, and Recovery (FDIR).

Rationale: NPR 8705.2, Human-Rating Requirements for Space Systems, mandates FDIR for faults of human-rated systems that affect critical functions. FDIR is required for crew safety and mission success because it enables the recovery of such critical *functions. In addition, fault detection enables crew abort or flight termination (in case of nonrecoverable failures). Fault isolation further enables common-mode failure identification, in-flight maintenance, and fleet supportability.*

3.2.5 Maintainability

Reserved

3.2.6 Transportability

3.2.6.1 Ground Transportability

[**R.LIDS.0115**] **Ground Transportability**
Packing shall be used in conjunction with preservation methods, handling procedures, and methods of transport to prevent damage or degradation in reliability or performance of the item when exposed to the natural and induced ground-based and transportation and ground handling environment.
Rationale: This is in accordance with NPR 6000.1, Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems, Equipment, and Associated Components.

3.2.7 JPR 8080.5 - JSC Design and Procedural Standards

[**R.LIDS.1109**] **JPR 8080.5 - JSC Design and Procedural Standards**
The iLIDS shall meet the JPR 8080.5, JSC Design and Procedural Standards, requirements marked applicable as specified herein in Appendix C.
Rationale: Adherence to NASA standards. The JPR 8080.5, JSC Design and Procedural Standards, provides design and procedural requirements for any human spaceflight program, project, spacecraft, system, or end item.

3.3 Design and Construction

[**R.LIDS.1108**] **Fastener Selection**
iLIDS fasteners used on removable structures and components shall be selected and designed in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Sections 11.9.3 and 14.6.3.3.
Rationale: This requirement adheres to approved standards.

[**R.LIDS.1117**] **Fastener Integrity**
iLIDS fasteners shall be in accordance with JPR 8730.2 JSC Fastener Integrity Testing Program.
Rationale: iLIDS contains numerous safety critical fasteners whose properties are crucial to the safe operation of iLIDS. Counterfeit or substandard fasteners could cause a structural failure of iLIDS and result in a catastrophic hazard.

3.3.1 Materials, Processes and Parts

3.3.1.1 Materials and Processes

[**R.LIDS.0116**] **Flight Hardware**
Materials and processes for flight hardware shall meet the requirements of NASA-STD-6016, Standard Material & Process Requirements for Spacecraft.
Rationale: This requirement adheres to approved standards.

3.3.1.2 Electrical, Electronic and Electromechanical (EEE) Parts

[**R.LIDS.0120**] **Electrical, Electronic, and Electromechanical Parts Selection**
The iLIDS shall comply with the design requirements contained in JSC-64924, iLIDS Electrical, Electronic and Electromechanical (EEE) Parts Management and Implementation Plan.
Rationale: This plan defines the requirements, processes and policies for an EEE Parts Control Program for the Project.

3.3.2 Structural Design

[**R.LIDS.0124**] **Structural Design and Verification Requirements**
The iLIDS shall be designed to meet the requirements in Section 3.0 of SSP 30559 Structural Design and Verification Requirements. Exception: SSP 30559 3.1.9.3 Dewars and 3.1.9.7 Burst Discs are not applicable.
Rationale: This requirement adheres to approved standards. For launch and unmated cases, the shuttle factors of safety will be used.

[**R.LIDS.0127**] **Fracture Control Design**
iLIDS shall implement the fracture control requirements specified in SSP 30558, Fracture Control Requirements for Space Station.
Rationale: Fracture control implementation is mandatory to ensure safety of the manned space systems. Implementation of Fracture Control is necessary to prevent premature failure of iLIDS structure due to flaws. NOTE: Retain reference to JSC-25863, Fracture Control Plan (FCP) for JSC Space-Flight Hardware for V&VD.

[**R.LIDS.0128**] **Mechanisms**
The iLIDS shall comply with Section 1 through Section 4 of NASA-STD-5017, Design and Development Requirements for Mechanisms.
Rationale: This requirement adheres to approved standards.

3.3.3 Nameplates and Product Marking

[**R.LIDS.0136**] **General Identification Marking Requirements**
The iLIDS shall use nameplates and product marking in accordance with MIL-STD-130, Identification Marking of U.S. Military Property.
Rationale: This is in accordance with approved standards.

[**R.LIDS.0137**] **Nomenclature Plan**
iLIDS nameplates and product marking shall use operational nomenclature related to on−orbit operations, which shall conform to SSP 50254, Operations Nomenclature.
Rationale: iLIDS shall adhere to standards currently in use for ISS hardware markings. Labeling applicable only to ground−based (nonoperational) functions may use other common technical terms. This is in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Section 9.5.3.1.2 (D).

[**R.LIDS.0286**] **Mounting/Alignment Labels/Codes**
The iLIDS shall be labeled or coded to identify proper mounting alignment
Rationale: Labels provide contextual information to help assure that ground crewmembers do not attempt to install an iLIDS incorrectly; such an attempt could

damage the iLIDS or the interfaces to the vehicle. Each iLIDS is verified for flight in its designed orientation and configuration.

3.3.4 Workmanship

[**R.LIDS.0139**] **Workmanship**
iLIDS shall be in accordance with SSP 30233, Space Station Requirements for Materials and Processes as implemented by JSC-27301, Materials Control Plan for JSC Flight Hardware.
Rationale: Adherence to approved standards.

[**R.LIDS.0293**] **Contamination Control**
iLIDS shall comply with the design requirements contained in SSP 30426, Space Station External Contamination Control Requirements.
Rationale: The Contamination Control Plan (CCP) defines requirements pertaining to vehicle spacecraft contamination prevention and control and is applicable to all vehicle spacecraft modules, subsystems and components during manufacturing, assembly, integration, test, storage, transportation, ground operations, mission operations, and post-flight recovery. The CCP does not contain operational constraints for on-orbit contamination control, such as when or what direction to vent. On-orbit contamination control is addressed through design requirements, such as material outgassing limits or design of protective covers.

[**R.LIDS.0294**] **Surface Cleanliness**
iLIDS surfaces shall at a minimum be Visibly Clean (VC) Sensitive in accordance with SN-C-0005, Contamination Control Requirements for the Space Shuttle Program, upon delivery for integration.
Rationale: iLIDS may require a more stringent level of cleanliness if the installation has proximity or exposure to more sensitive surfaces. Areas that are inaccessible in the final assembly and that may act as contamination sources while on orbit shall be cleaned to the visibly clean sensitive level of JSC SN-C-0005, Contamination Control Requirements for the Space Shuttle Program, before close–out. as specified in SSP 30426, Space Station External Contamination Control Requirements, Section 3.2.1.1.

[**R.LIDS.0298**] **iLIDS-to-Vehicle Interface Seal Cleanliness**
The iLIDS-to-Vehicle interface, seal gland, and seals shall at a minimum be Visibly Clean (VC) Highly Sensitive in accordance with SN-C-0005, Space Shuttle Contamination Control Requirements, upon delivery for integration.
Rationale: ISS levies a minimum VC sensitive level for space station components and user hardware per SSP 30426, Space Station External Contamination Control Requirements. iLIDS-to-Vehicle interface requires a higher VC Highly Sensitive level. This requirement is in accordance with SN-C-0005, Space Shuttle Contamination Control Requirements, Table A.2.

[**R.LIDS.1093**] **iLIDS-to-iLIDS Interface Seal Cleanliness**
The iLIDS-to-iLIDS interface, seal gland, and seals shall at a minimum be Visibly Clean (VC) Highly Sensitive in accordance with SN-C-0005, Space Shuttle Contamination Control Requirements, upon delivery for integration.
Rationale: ISS levies a minimum VC sensitive level for space station components and user hardware per SSP 30426, Space Station External Contamination Control

Requirements. iLIDS-to-Vehicle interface requires a higher VC Highly Sensitive level. This requirement is in accordance with SN-C-0005, Space Shuttle Contamination Control Requirements, Table A.2.

3.3.5 Human Engineering

[**R.LIDS.0158**] **Anthropometry**

The iLIDS internal hardware shall provide fit, access, reach, view, and operation of human-system interfaces in crew functional areas for unsuited crewmembers for the 5th percentile Japanese female to the 95th percentile American male anthropometric size measurement.

Rationale: This requirement is in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Section 3.3.

[**R.LIDS.0159**] **Range of Motion**

Aspects of the iLIDS with which unsuited Intravehicular Activity (IVA) crewmembers physically interact during planned tasks shall be within the ranges of motion provided in SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Figure 3.2.2.3.1-1.

Rationale: This requirement is in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Section 3.3.

3.3.5.3 Strength

[**R.LIDS.1084**] **Strength**

iLIDS internal hardware, which will have a crew interface under normal operations, shall accommodate the strength limitations of the 5th percentile American female in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Section 4.9.

Rationale: This is in accordance with approved standards.

3.3.5.4 Natural and Induced Environment

[**R.LIDS.0162**] **IVA Crew-Induced Loads**

The iLIDS internal structure shall meet requirements specified herein when exposed to IVA-crew induced loading as specified in SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Section 8.8.3.3.b.

Rationale: System components and hardware with which the crew interacts during nominal operations on-orbit must be able to withstand incidental contact by crewmembers without creating a hazard.

3.3.5.5 IVA Crew Safety

[**R.LIDS.0185**] **Corners and Edges**

Any iLIDS corners and edges to which the IVA crew is expected to be exposed during normal operations shall be rounded, as specified in SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), to protect the crew from injury due to sharp edges and corners.

Rationale: This requirement is in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Sections 6.3.3.1, 6.3.3.2, 6.3.3.3, and 6.3.3.11.

[**R.LIDS.0186**] **Loose Equipment**

Any iLIDS loose equipment, except for equipment with functional sharp edges, shall have corners and edges rounded, as specified in SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), to protect the crew from injury due to sharp edges and corners.
Rationale: This requirement is in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Sections 6.3.3.1, 6.3.3.2, 6.3.3.3, and 6.3.3.11.

[**R.LIDS.0187**] **Burrs**
Any iLIDS exposed surfaces shall be free of burrs.
Rationale: Removal of burrs can help to prevent personnel injury and damage to protective equipment from sharp edges during normal operations.

[**R.LIDS.0188**] **Pinch Points**
The iLIDS shall prevent pinch points from injuring the IVA crew.
Rationale: Pinch points can cause injury to the crew, but may exist for the nominal function of equipment (i.e., equipment panels). This may be avoided by locating pinch points out of the reach of the crew or providing guards to eliminate the potential to cause injury.

[**R.LIDS.0189**] **IVA Touch Temperature**
iLIDS surfaces, which are subject to IVA crewmember contact, shall meet the touch temperature requirements as specified in SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Section 6.5.3, Touch Temperature Design Requirements.
Rationale: iLIDS internal surface temperatures must be maintained within the touch temperature limits to prevent crewmember injury from momentary contact. iLIDS does not require continuous crewmember contact with any surfaces.

[**R.LIDS.0190**] **Labeling**
The iLIDS shall provide labels for crew interfaces, in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T) and SSP 50006, International Space Station Internal and External Decal and Placard Specification.
Rationale: This is to allow for identification of relevant features.

[**R.LIDS.0192**] **Language**
The iLIDS shall use text written in the American English language, as specified by Webster's New World Dictionary of American English.
Rationale: The intent of this requirement is to ensure as much commonality and consistency as possible in written text (i.e., language and spelling) across vehicle subsystems and across ISS systems. This will facilitate learning and minimize interface-induced crew error.

[**R.LIDS.0193**] **Use of Color**
The iLIDS shall provide an additional cue to convey IVA crew interface information when color is used to convey meaning.
Rationale: This requirement is in accordance with SSP 50008, International Space Station Interior Color Scheme, Section 3.2.6.

[**R.LIDS.0194**] **Units of Measure**
The iLIDS shall use System International (SI) units for interface definition characteristics (e.g. dimensions, loads, etc.)
Rationale: This is to establish ease of translation to an international docking standard. All production definition drawings that are defining Interface Definition Document (IDD) features will be dual-dimensioned. iLIDS non-interface drawings will use English units. iLIDS documentation will use English units with SI units in parenthesis. Refer to R.LIDS.1009.

[**R.LIDS.1009**] **Use of English Units**
The iLIDS shall use English units for non-interface definition characteristics (e.g. detail drawings, fasteners, etc.).
Rationale: All production definition drawings that are defining Interface Definition Document (IDD) features will be dual-dimensioned. iLIDS non-interface drawings will use English units. iLIDS documentation will use English units with SI units in parenthesis. Refer to [R.LIDS.0194].

[**R.LIDS.1104**] **Crew Protection for Electrical Shock**
iLIDS shall provide protection for the crew from electrical hazards in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Section 6.4.3
Rationale: The crew must be protected from potentially catastrophic electrical shock from the iLIDS electrical systems. This requirement is in accordance with SSP 50021 Safety Requirements Document, Section 3.3.6.8.2.

[**R.LIDS.1105**] **IVA Exposed Circular Holes**
Any exposed round or slotted holes on iLIDS accessible to IVA crew that are uncovered shall be less than 0.4 inches or greater than 1.0 inches in diameter for equipment located inside iLIDS.
Rationale: Holes should be sized either small enough to prevent crewmember finger entry or large enough such that crewmember fingers cannot be stuck or injured. This requirement is in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Section 6.3.3.4.

3.3.6 Safety

[**R.LIDS.0197**] **Hazard Analysis and Safety Risk Assessment**
A safety hazard analysis and safety risk assessment shall be performed for the iLIDS, as specified in SSP 30309, Safety Analysis and Risk Assessment Requirements Document.
Rationale: The foremost consideration for resolving hazards, identified by the hazard analysis process, is to eliminate hazards by removing hazard sources and hazardous operations. The methods for controlling critical and catastrophic hazards are failure tolerance and DFMR.

[**R.LIDS.1092**] **Control System Safety Requirements**
The iLIDS shall be designed in accordance with SSP 50038, Computer-Based Control System Safety Requirements, excluding TBD-208
Rationale: Compliance with ISS program safety requirements. Verification of this requirement may be satisfied via a combination of hazard controls at the iLIDS level and

at the integrated system level (including both the VV and ISS). In areas where iLIDS cannot meet this requirement alone, the required integrated hazard controls will be documented as an interface requirement in the appropriate ICD/IDD and the hazard reports will reference those requirements as appropriate. Personnel considered include all flight and ground crews.

[**R.LIDS.1102**] **Design For Minimum Risk**

iLIDS hazards related to DFMR areas of design shall be controlled by the safety-related properties and characteristics of the design. The failure tolerance criteria are only to be applied to these designs as necessary to ensure that credible failures that may affect the design do not invalidate the safety related properties of the design.

Rationale: This requirement is in accordance with SSP 41000, System Specification for the International Space Station, Section 3.3.6.1.2. DFMR are areas where hazards are controlled by specification requirements that specify safety-related properties and characteristics of the design that have been baselined by the ISS program requirements rather than failure tolerance criteria. The failure tolerance criteria of R.LIDS.0106 will only be applied to these designs as necessary to ensure that credible failures that may affect the design do not invalidate the safety-related properties of the design. For example, a pressure vessel shall be certified safe based upon its inherent properties to withstand pressure loading that have been verified by analysis and qualification and acceptance testing; however, failure tolerance must be imposed upon external systems that might affect the vessel, such as a tank heater, to ensure that failures of the heater do not cause the pressure to exceed the MDP of the pressure vessel. Examples are mechanisms, structures, glass, pressure vessels, pressurized lines and fittings, functional pyrotechnic devices, material compatibility, flammability, etc.

[**R.LIDS.1103**] **Pyrotechnic Operated Devices**

iLIDS (excluding -302) shall provide pyrotechnic devices designed and tested to the requirements of JSC-62809, Human Rated Spacecraft Pyrotechnic Specification.

Rationale: iLIDS pyrotechnic devices must meet pyrotechnic requirements to ensure safe pyrotechnic design and operation. This requirement is in accordance with SSP 50021 Safety Requirements Document, Section 3.3.6.5.1.3.

[**R.LIDS.1106**] **Verifiable Seal Leakage Paths**

iLIDS project shall provide for redundancy and verifiability requirements for leak paths through the pressurized module to external environment in accordance with the criteria listed in Seal Redundancy and Verifiability Requirements table.

Table 3.3-1 - Seal Redundancy and Verifiability Requirements

Seal	Redundancy and verifiability requirements [2,3,4,5]	
	D<= 6.0 inches	D> 6.0 inches
Feed-through connections[1]	A	B
Host vehicle Interface	A	B
Docking	A	B

Notes:
(1) Includes valves, gages, transducers, etc.
(2) D = Major diameter of the seal
(3) A = Interface shall have two seals. The interface shall be verifiable prior to launch.
(4) B = Interface shall have two seals. Each seal shall be verifiable prior to launch.
(5) The interface may be verified in flight after docking via vestibule pressurization and leak check prior to hatch opening.

Rationale: This requirement is derived from SSP 50021, Safety Requirements Document, paragraph 3.2.2.7, but removes the requirement for on-orbit individual seal leakage verification for seals with a diameter greater than 6 inches; the requirement was tailored to be consistent with current docking and berthing operations on ISS.

3.3.7 Operational Lifetime

[**R.LIDS.0201**] **On-Orbit Design Life - Long Duration**
The iLIDS (-302) shall be designed to meet a maximum of 15 years on-orbit design life without maintenance.
Rationale: The current manifest shows a 10-year ISS life after CDA delivery. In order to avoid recertification in the event of ISS life extension, iLIDS (-302) will certify to 15 years. This equates to a Mean Time To Failure (MTTF) of 15 years.

[**R.LIDS.0202**] **iLIDS On-Orbit Design Life without Maintenance - Short Duration**
The iLIDS (excluding -302) shall be designed to meet a minimum of 231 days on-orbit design life with no maintenance.
Rationale: The 231 days are as follows:

a. Umated operations on orbit: 21 days

- Ultraviolet exposure not to exceed 214 equivalent Sun hours (TBR-212)

b. Maximum mission duration: 210 days

[**R.LIDS.0203**] **Shelf Life**
The iLIDS shall be designed to meet a minimum 5-year shelf life.
Rationale: The intent of this requirement is to specify a minimum life prior to required maintenance. The shelf life is derived from the longest time between manufacture and delivery of the iLIDS. This will be verified by the Limited Life Item List (LLIL).

[**R.LIDS.0207**] **Launch**
The iLIDS shall be designed to meet a minimum of one launch.
Rationale: iLIDS must survive the minimum cycles for launch in order to meet operational life. Launch includes one Earth launch.

[**R.LIDS.0206**] **iLIDS Passive Mode Docking/Undocking Cycles**

The iLIDS shall be capable of a minimum of 70 passive mode docking/undocking operations.

Rationale: This includes 20 ground operations and fifty flight cycles. Fifty cycles is calculated by a 15-year life with three missions per year and a margin of five. The cycles are defined as a full docking/undocking sequence. The 70 passive mode docking/undocking cycle operations does not account for component level cycles (i.e. flex-drive, actuators, etc.).

[**R.LIDS.1060**] **iLIDS Active Mode Docking/Undocking Cycles**

The iLIDS shall be capable of a minimum of 24 active mode docking/undocking operations.

Rationale: This includes 20 ground operation cycles and four flight cycles. The cycles are defined as a full docking/undocking sequence. The 24 active mode docking/undocking cycle operations does not account for component level cycles (i.e. flex-drive, actuators, etc.).

3.3.8 Electrical Parts and System Design, Construction, and Verification

[**R.LIDS.1120**] **iLIDS Electrical Boxes**

iLIDS Electrical Boxes shall include captive fasteners.

Rationale: This is to allow the electrical boxes to be compatible with potential IVA replacement. However, IVA replacement must be considered on a case by case basis depending on integration with the host Vehicle.

[**R.LIDS.1126**] **Host Electrical Power Interface - Modularity**

The iLIDS shall allow for reconfiguration to alternate host vehicle power values.

Rationale: An electrical power interface is needed to allow the host vehicle to power the iLIDS. This is the power for iLIDS consumption, which is not to be confused with the host vehicle pass-through power to the mating vehicle. Host vehicles may operate with different nominal power configurations (e.g. 28 Vdc, 120 Vdc, etc.). This requirement allows for a modular power system to accommodate multiple hosts. The host vehicle power must be specified at the time of the delivered docking system buildup; the system cannot accept multiple power configurations at the same time.

3.3.8.1 Mating of Electrical Connectors

[**R.LIDS.0211**] **Connector Mating Labels**

iLIDS connectors in the same physical location, which must be mated during launch site processing and maintenance, shall have labels defining correct mating.

Rationale: This requirement is in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Section 11.10.3.5.

[**R.LIDS.1127**] **IVA Connectors**

The iLIDS connectors shall allow for IVA mate/demate operations in support of contingency maintenance operations in orbit.

Rationale: The iLIDS assembly does not count for nominal maintenance in flight. However, iLIDS connectors on the electronics boxes are designed to be mated/demated by an IVA operator if a contingency ORU replacement is required.

3.4 Logistics

3.4.1 Maintenance

3.4.1.1 On-Orbit Maintenance

No on orbit maintenance is planned; however, refer to R.LIDS.1108, R.LIDS.1120 and R.LIDS.1127 for requirements on captive fasteners and IVA connectors to support potential on-orbit replacement of electrical boxes.

3.4.1.2 Ground Maintenance

[**R.LIDS.0229**] **Tool Clearance**

The iLIDS shall provide tool clearances for tool installation and actuation for all tool interfaces during ground maintenance.

Rationale: No further rationale is required.

3.5 Software Standards

[**R.LIDS.0239**] **Software Engineering**

The iLIDS software shall be developed in accordance with NPR 7150.2, NASA Software Engineering Requirements.

Rationale: This is in accordance with approved standards.

[**R.LIDS.0240**] **Software Safety**

The iLIDS software shall be in accordance with NASA-STD-8719.13, Software Safety Standard.

Rationale: This is in accordance with approved standards.

[**R.LIDS.0241**] **Software Assurance**

The iLIDS software shall be in accordance with NASA-STD-8739.8, NASA Software Assurance.

Rationale: This is in accordance with approved standards.

4 GROUND SUPPORT EQUIPMENT REQUIREMENTS

4.1 Ground Support Equipment Interface Definition

The iLIDS incorporates the following interfaces to Ground Support Equipment (GSE):

- Power
- Command and Data Handling (C&DH)
- Structural/Mechanical - The iLIDS-to-GSE interface is illustrated in the iLIDS-to-GSE Interface Diagram figure.

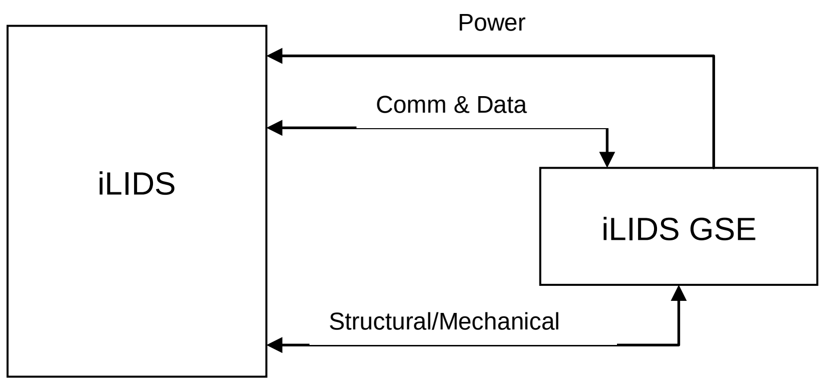


Figure 4.1-1 - iLIDS to GSE Interface Diagram

[**R.LIDS.0043**] **GSE Command and Data Handling Interface**
The iLIDS shall provide a unique C&DH interface for GSE separate from the host Vehicle interface to allow ground-check out and testing.
Rationale: A separate interface is needed to allow checkout of the system after installation on the host Vehicle. This allows for docking system evaluation without requiring the host Vehicle's computer system.

[**R.LIDS.0044**] **Structural Interface**
The iLIDS shall provide a structural interface for GSE.
Rationale: An interface between iLIDS and GSE is needed during ground testing.

4.2 GSE Requirements

4.2.1 General

[**R.LIDS.1083**] **General**
All iLIDS GSE shall conform to NASA-STD-5005, Ground Support Equipment.
Rationale: These NASA standards for GSE and GSE hardware must be maintained and controlled as Class I. The standards ensure that uniform engineering practices, methods, and essential criteria are employed in the design of GSE used within NASA.

4.2.2 Ground Support and Transportation

4.2.3 Ground Crew Interfaces

[**R.LIDS.0256**] **Labeling**

The iLIDS including iLIDS GSE shall provide labels for ground crew interface controls and indicators.
Rationale: This is in accordance with SSP 50005, International Space Station Flight Crew Integration Standard (NASA-STD-3000/T), Section 9.5.3.1.

[**R.LIDS.0259**] **Hazards Labeling**
The iLIDS GSE shall provide labels to identify hazards to ground crew or to equipment.
Rationale: Hazard labeling shall be verified by inspection. The inspection shall identify the list of equipment that is susceptible to damage or constitutes a hazard to the ground crew. This list will include the type of hazard [Electrostatic Discharge (ESD), chemical, pressurized fluid, etc.]. The verification shall be considered successful when the inspection shows that all items on the list have been labeled with hazard information.

5 PREPARATION FOR DELIVERY

5.1 Packaging Specification

[**R.LIDS.0297**] **Packaging Specification**

Packaging, Handling and Transportation for iLIDS shall comply with NPR 6000.1.

Rationale: NPR 6000.1 is the primary document for packaging, handling, and transportation. Reference NPR 6000.1, Section 2.1.

6 CUSTOMER IMPOSED VERIFICATION REQUIREMENTS

7 NOTES

APPENDIX A ACRONYMS AND ABBREVIATIONS

ANSI	American National Standards Institute
AO	Atomic Oxygen
APAS	Androgynous Peripheral Assembly System
APDS	Androgynous Peripheral Docking System
ASDS	Abort System to Docking System
ASE	Airborne Support Equipment
AWG	American Wire Gauge
B.C.	Bolt Circle
C&DH	Command and Data Handling
C&T	Communication & Tracking
CAD	Computer-Aided Drawing
CARD	Constellation Architecture Requirements Document
CCP	Contamination Control Plan
CCSDS	Consultative Committee for Space Data Systems
CDA	Common Docking Adapter
CDMA	CEV Docking Mating Adapter
CDR	Critical Design Review
CE	Complex Electronics
CEV	Crew Exploration Vehicle
CID	Command ID
CIL	Critical Items List
CLV	Crew Launch Vehicle
CM	Crew Module
COTS	Commercial Off The Shelf
CPCB	Crew Exploration Vehicle Project Control Board
CRC	Cyclic Redundancy Check
CxP	Constellation Program
°C	Degrees Celsius
°F	Degrees Fahrenheit
DC	Direct Current
D&C	Display and Control
DAC	Design Analysis Cycle
DEM	Data Exchange Message
DFMR	Design for Minimum Risk
DIA	Diameter
DMJS	Docking Mechanism Jettison System
DRD	Data Requirements Description
DRM	Design Reference Mission
DSNE	Design Specification for Natural Environments
E3	Electromagnetic Environmental Effects

EA	Engineering Directorate
EA3	Systems Architecture and Integration Office
ECD	Estimated Closure Date
EEE	Electrical, Electronic, and Electromechanical
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMU	Extravehicular Mobility Unit
EPS	Electrical Power System
ESD	Electrostatic Discharge
ESDS	Electrostatic Discharge Sensitive
EVA	Extra-Vehicular Activity
FCP	Fracture Control Plan
FDIR	Fault Detection, Isolation, and Recovery
FMEA	Failure Modes and Effect Analysis
FOD	Foreign Object Debris
FRAM	Flight Releasable Attachment Mechanism
FT	Fault Tolerance
GFE	Government Furnished Equipment
GN&C	Guidance, Navigation, and Control
GPC	General Purpose Computer
GSE	Ground Support Equipment
H&S	Health and Status
HCS	Hard Capture System
HDLC	High-Level Data Link Control
I/F	Interface
ICD	Interface Control Document
ID	Internal Diameter
IDD	Interface Definition Document
IDSS	International Docking System Standard
IEEE	Institute of Electrical and Electronic Engineers
IFM	In-Flight Maintenance
iLIDS	International Low Impact Docking System
in.	Inch(es)
IRD	Interface Requirements Document
ISO	International Standards Organization
ISS	International Space Station
IVA	Intravehicular Activity
JPR	JSC Program Requirements
JSC	Johnson Space Center
LAS	Launch Abort System
lbf	Pound-Force
LET	Linear Energy Transfer
LLIL	Limited Life Item List

LOC	Loss of Crew
LOM	Loss of Mission
LRU	Line Replaceable Units
LSAM	Lunar Surface Access Module
KOZ	Keep-Out Zone
MDP	Maximum Design Pressure
MGA	Mass Growth Allowance
MIL	Military
MLI	Multi-Layer Insulation
mm	Millimeter
MMOD	Micrometeoroid and Orbital Debris
MMPDS	Metallic Materials Properties Development and Standardization
MPE	Maximum Predicted Environment
ms	Millisecond
MSID	Measurement Identification
MTV	Mars Transfer Vehicle
NASA	National Aeronautics and Space Administration
NDS	NASA Docking System
NPR	NASA Processes and Requirements
NSI	NASA Standard Initiator
OA	ISS Program Office
OD	Orbital Debris
OD	Outer Diameter
ODS	Orbiter Docking System
OMRS	Orbiter Maintenance Requirements Specification
ORU	Orbital Replacement Unit
P/N	Part Number
PDR	Preliminary Design Review
PDU	Power Distribution Unit
PMA	Pressurized Mating Adapter
PNP	Probability of No Penetration
psi	Pounds per Square Inch
rms	Root Mean Square
RPC	Remote Power Controller
RTH	Ready To Hook
RX	Receive
SCS	Soft Capture System
sec	Second
SI	International System of Units
SLT	Self Locking Torque
SM	Service Module
SQA	Software Quality Assurance
SR&QA	Safety, Reliability and Quality Assurance

SRD	Systems Requirements Document
SRR	System Requirements Review
SSP	Space Shuttle Program
STD	Standard
STS	Space Transportation System
TBD	To Be Determined
TBR	To Be Resolved
TCS	Thermal Control System
TIM	Technical Interchange Meeting
TLI	Trans-Lunar Injection
TLVs	Threshold Level Values
TMG	Thermal/Micrometeoroid Garment
TX	Transmit
UML	Unified Modeling language
UV	Ultraviolet
V	Volt
V&VD	Verification and Validation Document
VAB	Vehicle Assembly Building
VC	Visibly Clean
Vdc	Volts Direct Current
VM	Vehicle Manager
VMC	Vehicle Management Computer
VSM	Vehicle Systems Management
VSM	Vehicle Management Computer
W	Watt
W-hrs	Watt-hours
WS	Workmanship Specification

APPENDIX B DEFINITION OF TERMS

Term	Definition
Active iLIDS	An iLIDS (International Low Impact Docking System) that has electro-mechanical actuation controlled features such as linear actuators, motor driven hooks and electro-magnets. An "Active iLIDS" can only interface with a "Passive iLIDS" (see definition of Passive iLIDS below in this table).
Active Mode	A functional mode of iLIDS. An active iLIDS performs all capture and structural attachment to the passive iLIDS. See definition of Passive Mode.
Alignment	Alignment is the function that allows iLIDS to compensate and correct to the proper orientation necessary for successful soft capture.
Androgynous	Hardware that does not have distinct male or female characteristics, all hardware are identical in form and function.
Backout	A dynamic process in which a maneuvering vehicle halts its approach to the target and separates along a controlled path (within the approach/departure corridor) to a planned, safe station keeping range. A backout is normally followed by a resumed approach or breakout maneuver.
Berth	Mating method that allows connection of two vehicles with the assistance of a robotic arm or a Remote Manipulator System (RMS)-type device.
Breakout	A dynamic process in which a maneuvering vehicle alters its intercept approach to a target and separates with the intention of not immediately resuming the approach that day. A second rendezvous is necessary to reestablish intercept conditions. In emergency scenarios, the maneuvering vehicle may perform an emergency deorbit burn as part of the breakout sequence.
Bulkhead	A bulkhead is a partition inside a ship, aircraft, or large vehicle.
Bulkhead Connectors	The bulkhead connectors are those that pass through a pressurized bulkhead.
Capture	The use of a docking mechanism to bring an approaching vehicle from a free flight state to a physically connected state (but not fully constrained) with the mating vehicle. Capture enables placement of the system in a controlled orientation in preparation for hard mate. When captured, the system may be easily released and is typically unable to withstand its full mechanical loading environment.

Catastrophic Hazard	A catastrophic hazard is a condition that may cause loss of life or a permanently disabling injury. It also includes a condition that may cause loss of vehicle, prior to completing its primary mission. For example, a hazard that could cause loss of Orion prior to rendezvous with the LSAM is considered catastrophic. A hazard that may cause loss of Orion after crew evacuation, during a water landing, would not be considered catastrophic.
CheckSum	CheckSum is a value transmitted with a data stream, derived from the other elements in the data stream, and used to check for transmission errors in the data. If the transmitted checksum differs from the one derived by the receiving computer, a transmission error has probably occurred and the transmission is repeated.
Command	A command is an instruction to a computer to carry out an operation.
Command/Response Packet	This is a message or part of a message packaged as a fixed-size segment of data for transmission through a computer network.
Control Box	The control box is an enclosure that houses a computer system.
Control Pendant	This is a handheld control box.
Critical Hazard	A critical hazard is a condition that may cause a severe injury or occupational illness, loss of mission, or major property damage to facilities, systems, or flight hardware, but does not meet the criteria of a catastrophic hazard.
Demate	Demating is a function that can be performed by one of either two methods: undocking or unberthing. Demated also signifies structural separation once undocking/ unberthing operations are complete.
Design Reference Mission (DRM)	Typical mission scenario encompassing tasks that are most likely to drive the architecture system design requirements. The DRMs are analyzed for all mission aspects from failure tolerance to hardware layout, software functionality, and design suitability.
Dock	Docking is the mating of two independently operating spacecraft or other systems in space, using independent control of the two vehicles’ flight paths and attitudes during contact and capture. Docking begins at the time of initial contact of the vehicles’ docking mechanisms and concludes when full rigidization of the interface is achieved.
Extravehicular Activity (EVA)	EVA operations are performed by suited crew outside the pressurized environment of a flight vehicle or habitat (during space flight or on a destination surface).

Failure Detection, Isolation, and Recovery (FDIR)	Determining the occurrence of a fault/failure, determining what caused the fault/failure, and providing corrective action.
Failure Modes and Effects Analysis (FMEA)	FMEA is the study of a system and the working relationships of its elements to determine ways in which failure can occur (failure modes), and the effects of each potential failure on the system element in which it occurs on other systems.
Fault	An anomalous condition of a system, which includes hardware and software.
Fault Detection	Determine and notify fault occurrence.
Fault Tolerance	Built-in capability of a system to perform as intended in the presence of specified hardware or software faults. EVA, emergency systems, or emergency operations may not be used as a leg of fault tolerance.
Ground Support Equipment (GSE)	All equipment (implements, tools, test equipment devices, simulations, etc.) required on the ground to support appropriate ground testing or training.
Hard Capture	A hard capture is when two docking vehicles are structurally connected, sealing is complete, vestibule is ready for equalization and hatch is ready to open. This is also the state when a vehicle or payload is rigidly attached to the capture mechanism and relative motion is fully constrained.
Health and Status	This is information on subsystem performance and flight performance, including configuration data, vehicle state data, subsystem status, failures, hazards, and measured parameters outside of normal limits.
Induced Environment	Any form of matter or energy released, radiated or modified by one component or System that could impact or influence another component or System. Includes radiated and reflected thermal energy; vibrations, aerodynamic, and shock loads; electromagnetic energy, Paschen discharge, arcing, glow discharge, spacecraft charging, and V x B voltages; debris; particulate and molecular contamination, waste water dumps; and reflections, glows, and other optical contamination.
Intravehicular Activity (IVA) maintenance	An IVA is corrective or preventive maintenance performed by the crew within the pressurized spacecraft during a mission.
iLIDS	See Definition in Sec. 3.1, and Sec. 3.1.1 of the document
LIDS	Low Impact Docking System acronym from heritage design still used in legacy data utilized in iLIDS project (e.g. Command labels, requirements ID's, etc.)

Maintainable	The ability of a system to be retained in or restored to a specified condition when maintenance is performed in a stated time interval, under stated conditions, and using stated procedures and resources. Maintenance, preventative and corrective, may include identification, safing access, removal, replacement, restoration, and verification of functionality.
Mating	Mating is the mechanical connection of two vehicles, in space (via docking or berthing) or on the Earth, Moon, or Mars (via docking, berthing, or some other method). When the mating is successfully accomplished, the two vehicles are hard-mated and mated operations commence.
Mating Connector	TBD
Mating Vehicle	In rendezvous and proximity operations, the mating vehicle performs minimal, if any maneuvers.
MMOD	Micro Meteoroid Orbital Debris
MMOD Shield	Micro Meteoroid Orbital Debris Shield is made up of thin Aluminum, Nextel and Kevlar materials. The MMOD shield protects iLIDS from MMOD strikes.
Orbital Replacement Unit (ORU)	A piece of equipment that can be removed and replaced with a working spare by a user or operator during the mission.
Passive iLIDS	An iLIDS (International Low Impact Docking System) that has no electro-mechanical actuation controlled features. A “Passive iLIDS” can only interface with an “Active iLIDS.” (see definition of an Active iLIDS above in the Table)
Passive Mode	A functional mode of iLIDS. A passive iLIDS allows the Active iLIDS to perform all capture and structural attachment to the passive iLIDS. See definition of Active Mode.
Seal Gland	A machined groove into which a seal is installed.
Soft Capture	A soft capture is a iLIDS function where the electromagnets are used to attach mating mechanisms. This is not structural mating, but the first level of attachment.

Special Processes	Processes where the resulting output cannot be verified by subsequent monitoring or measurement. (e.g., deficiencies become apparent only after the product is in use or the service has been delivered). Special processes include, but are not limited to, soldering, coating/painting, cleaning, non-destructive examinations, plating, welding, brazing. **A defense industry consensus list of special processes** NDT: Liquid Penetrant, Magnetic Particle, Ultrasonics, X-ray Heat Treating: For multiple Alloy Families: Stress Relieving, Annealing, Carburizing, Nitriding, Carbonitiriding, Ferritic Nitrocarburizing, Ion Nitriding, Vacuum Heat Treating, Vacuum Oil Quenching, Hardening, Induction Hardening, Furnace Brazing, Dip Brazing, Induction Brazing, Vacuum Furnace Brazing, Flame Hardening, Cryogenic Treatments, Hot Forming/Hot sizing, Die Quenching, Hipping, Hardness and Metallography to support the heat treating function Welding: Torch/Induction Manual Brazing, Flash Welding, Electron Beam Welding, Fusion Welding, Laser Welding, Resistance Welding, Friction/Inertia Welding, Diffusion Welding, Percussion Stud Welding. Coatings: Thermal Spray, Vapor Deposition, Cementation, Stripping, Coating Evaluations, Plating of Coated Parts, Heat Treating of Coatings Chemical Processing: Plating, Anodizing, Conversion/Phosphate Coatings, Paint and Dry Film Lubricants, Etch Materials Testing Laboratories: Chemical, Mechanical, Metallography & Microhardness, Hardness, Corrosion, Mechanical Test Specimen Preparation, Differential Thermal Analysis, X-Ray Diffraction, Coating Evaluations, Fastener Testing
TBD	Acronym for To Be Determined. Inserting TBD indicates values or information have yet to be added, but will be determined prior to document baseline.
TBR	Acronym for To Be Resolved. Inserting TBR indicates that the information provided is tentative and is subject to change, if approved by project and program.
TBS	Acronym for To Be Specified. Inserting TBS indicates that the information provided is information that has yet to be added.
TIA/EIA-422	ANSI/TIA/EIA-422-B specifies the electrical signaling characteristics of the data link.

Umbilical Systems	This system provides a link or system of links to something essential.
Undocking	Demating of spacecraft or other elements in space using independent control of the two vehicles' flight paths and attitudes during release. Undocking is done without the assistance of a robotic arm or a RMS-type device.

APPENDIX C MISCELLANEOUS INFORMATION

Table C-1 Compliance Document Applicability

JPR 8080.5 standards carry multiple requirements within each standard. For standards that have "Partially Applicable" applied, the standard is decomposed into individual shall statements and a preceding number is applied to each shall statement within the standard starting with (1). The numbering allows exception of individual sections of the JPR 8080.5 standard as well as partial applicability.

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
JPR 8080.5	E-1	Mating Provisions for Electrical Connectors	Applicable		
JPR 8080.5	E-2	Protection of Severed Electrical Circuits	Not Applicable	iLIDS conductors are not cut using guillotine devices.	
JPR 8080.5	E-3	Electrical and Electronic Devices Protection from Reverse Polarity and/or Other Improper Electrical Inputs	Applicable		
JPR 8080.5	E-4	Electrical Connectors - Moisture Protection	Applicable		
JPR 8080.5	E-5	Electrical Connectors - Pin Assignment	Applicable		
JPR 8080.5	E-6	Corona Suppression	Applicable	Corona is applicable with the custom power supply design inside of the 120V iLIDS that has peak voltages of 300+V.	
JPR	E-7	Electrical	Applicable		

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
8080.5		Components - Restrictions on Use			
JPR 8080.5	E-8	Electrical / Electronic Supplies and Loads - Verification Tests	Applicable		
JPR 8080.5	E-9	Electrical Circuits - Deenergizing Requirement	Not Applicable	Vehicle level requirement.	
JPR 8080.5	E-10	Cleaning of Electrical and Electronic Equipment	Applicable		
JPR 8080.5	E-11	Protective Covers or Caps for Electrical Receptacles and Plugs	Applicable		
JPR 8080.5	E-12	Electrical Connectors - Disconnection for Trouble-Shooting and Bench Testing	Applicable		
JPR 8080.5	E-13	Bioinstrumentation Systems - Crew Electrical Shock Protection	Not Applicable	iLIDS is not a Bioinstrumentation System.	
JPR 8080.5	E-14	Electrical Wire Harnesses - Acceptance Testing	Applicable		
JPR 8080.5	E-15	Electrical Power Distribution Circuits	Applicable		

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
		- Overload Protection & Fault Propagation			
JPR 8080.5	E-16	Testing Protective Devices for Electrical and Electronic Circuits	Applicable		
JPR 8080.5	E-17	Electrical and Electronic Piece Parts - Hermetic Construction	Not Applicable	Other functional requirements specified in the iLIDS PTRS will provide necessary protection from damage, the parts need not be hermetically sealed.	
JPR 8080.5	E-18	Circuitry for Automatic Shutdown of Launch Vehicle Engine(s)	Not Applicable	Reclassified as G-54.	
JPR 8080.5	E-19	Equipment Design - Power Transients	Applicable		
JPR 8080.5	E-20	Electrostatic Discharge Protection of Electronic Equipment	Applicable		
JPR 8080.5	E-21	Electrical Connectors	Not Applicable	Cancelled	
JPR 8080.5	E-22	Ionizing Radiation Effects on Electronics	Partially Applicable	E-22(2) and E-22(3) are not applicable - iLIDS will not use these test levels. E-22(7) and E-22(8) are not applicable - iLIDS will not use the suggested methods.	
JPR	E-23	Transistors -	Not Applicable	Cancelled	

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
8080.5		Selection of Types			
JPR 8080.5	E-24	Electrical Wire and Cable Acceptance Tests	Applicable		
JPR 8080.5	E-25	Protecting Electrical Wires, Cables, Bundles, and Harnesses	Applicable		
JPR 8080.5	F-1	Restriction Requirements - Pressurized Components	Not Applicable	No relative hardware on iLIDS.	
JPR 8080.5	F-2	Water Separators in a Zero-Gravity Environment	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-3	Service Points - Positive Protection From Interchangeability of Fluid Service Lines	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-4	Ground Service Points - Fluid Systems	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-5	Fluid Lines - Separation Provisions	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-6	Temperature and Pressure Monitoring Requirements for Potentially	Not Applicable	iLIDS has no fluid transfer requirements.	

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
		Hazardous Reactive Fluids			
JPR 8080.5	F-7	Capping of Servicing and Test Ports not Required to Function in Flight	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-8	Fluid System Components Whose Function is Dependent on Direction of Flow - Protection Against Incorrect Installation	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-9	Spacecraft Venting - Induced Perturbing Forces	Not Applicable	iLIDS is not a spacecraft.	
JPR 8080.5	F-10	Nozzle and Vents - Protection Prior to Launch	Not Applicable	iLIDS has no relative hardware	
JPR 8080.5	F-11	Fluid Supplies - Verification Test Provisions	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-12	Protection of Pressurized Systems from Damage Due to Pressurant Depletion -Support Equipment	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-13	Habitable Module Pressure - Venting	Not Applicable	iLIDS has no fluid transfer requirements.	

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
		Restriction			
JPR 8080.5	F-14	Crew Cabin Module Ventilating Fans - Protection From Debris	Not Applicable	Cancelled	
JPR 8080.5	F-15	Separation of Hypergolic Reactants	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-16	Fluid Line Routing Installation	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-17	Cleanliness of Flowing Fluids and Associated Systems	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-18	Pressure Relief Valves - Standardization of Functional Testing	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-19	Cleanliness Protection for Fluid Systems	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-20	Fluid Systems - Cleanliness	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-21	Purge Gases - Dew Point Requirements	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-22	Pressure Garments - Protection Against Failure Propagation	Not Applicable	Relative hardware doesn’t exist on iLIDS.	
JPR 8080.5	F-23	Qualification Fluid	Not Applicable	Reclassified as G-53.	
JPR 8080.5	F-24	Fluid Systems - Design for Flushing	Not Applicable	iLIDS has no fluid transfer requirements.	

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
		and Draining			
JPR 8080.5	F-25	Toxicity - Fluids Contained in Systems in the Crew Compartment	Applicable		
JPR 8080.5	F-26	Atmosphere Pressure and Composition Control	Not Applicable	iLIDS is not a Spacecraft or habitable module.	
JPR 8080.5	F-27	Liquid or Gas Containers - Verification of Contents	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-28	Use of Halogen Method for Coolant System Leak Detection	Not Applicable	Cancelled	
JPR 8080.5	F-29	Filter Protection of Active Fluid Components	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	F-30	Pressure Relief for Pressure Vessels	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	G-1	Equipment Accessibility for Maintenance	Partially Applicable	G-1(4), G-1(5) not applicable - iLIDS is not habitable.	
JPR 8080.5	G-2	Separation of Redundant Equipment	Applicable		
JPR 8080.5	G-3	Electrical and Fluid Systems Checkout Provision	Applicable		
JPR	G-4	Protection from	Applicable		R.LIDS.0295

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
8080.5		Debris - Electrical & Mechanical Systems			
JPR 8080.5	G-5	Prevention of Debris - Electrical & Mechanical Systems.	Applicable		
JPR 8080.5	G-6	Redundancy Requirements	Not Applicable	Cancelled	
JPR 8080.5	G-7	Time Displays	Not Applicable	Cancelled	
JPR 8080.5	G-8	Design for Redundancy Verification	Applicable		
JPR 8080.5	G-9	Shatterable Material - Exclusion	Not Applicable	Shatterable materials are not consistent with the iLIDS design and functions. It is not foreseeable that iLIDS would include a shatterable material.	
JPR 8080.5	G-10	Parts identification	Applicable		
JPR 8080.5	G-11	Procurement Document Identification for Human Spaceflight Items	Not Applicable	Non-functional requirement.	
JPR 8080.5	G-12	Application of Previous Qualification Tests	Not Applicable	iLIDS has no previous qualification data.	
JPR 8080.5	G-13	Shipping and Handling Protection for Spaceflight	Not Applicable	Cancelled	

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
		Hardware			
JPR 8080.5	G-14	Classification of Flight and Non-Flight Equipment	Not Applicable	Non-functional requirement.	
JPR 8080.5	G-15	Resolution of Flight Equipment Failures/Anomalies Prior to Launch	Applicable		
JPR 8080.5	G-16	Operational Limits on Temperature-Controlled Equipment	Applicable		R.LIDS.0091, R.LIDS.1051
JPR 8080.5	G-17	Separate Stock for Spaceflight Parts and Materials	Applicable		R.LIDS.0136, R.LIDS.0297
JPR 8080.5	G-18	Safety Precautions-Test and Operating Procedures	Applicable		
JPR 8080.5	G-19	Special Processes-Identification of Drawings	Partially Applicable	G-19 (3) not applicable - non-functional requirement	
JPR 8080.5	G-20	Spacecraft Equipment - Protection from Liquids During Ground Operations	Applicable		
JPR 8080.5	G-21	Spacecraft Equipment - Moisture Protection	Applicable		R.LIDS.1077, R.LIDS.1078
JPR 8080.5	G-22	Parts Identification	Applicable		R.LIDS.0136, R.LIDS.0137
JPR	G-23	Pressure Garment	Not Applicable	No relative hardware on iLIDS.	

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
8080.5		Wiring - Ignition of Materials by Electrical Current			
JPR 8080.5	G-24	Protecting Flight Equipment From Support Equipment	Applicable		
JPR 8080.5	G-25	Thermal Design and Analysis	Applicable		R.LIDS.1051
JPR 8080.5	G-26	Internally Generated Radiation	Not Applicable	No laser sources on iLIDS.	
JPR 8080.5	G-27	Fire control	Applicable		
JPR 8080.5	G-28	Sealing - Solid Propellant Rocket Motors	Not Applicable	No relative hardware on iLIDS.	
JPR 8080.5	G-29	Reentry Propulsion Subsystem In-Flight Test	Not Applicable	No relative hardware on iLIDS.	
JPR 8080.5	G-30	Switch Protection Devices	Not Applicable	Cancelled	
JPR 8080.5	G-31	Detachable Crew-Operated Actuating Tools	Applicable		
JPR 8080.5	G-32	Measurement Systems That Display Flight information to the Crew - Indication of Failure	Not Applicable	Cancelled	
JPR 8080.5	G-33	Surface Temperatures	Not Applicable	Cancelled	

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
JPR 8080.5	G-34	Extravehicular Activity Electronic Connectors	Not Applicable	Cancelled	
JPR 8080.5	G-35	Enclosure Panels External to the Habitable Modules	Not Applicable	Cancelled	
JPR 8080.5	G-36	Thermal Blankets - Extravehicular Activity	Not Applicable	Cancelled	
JPR 8080.5	G-37	Verification of External Visibility	Not Applicable	iLIDS is not a crewed spacecraft.	
JPR 8080.5	G-38	Pressurization or Repressurization-Precluding Ingress of Undesirable Elements	Not Applicable	iLIDS is not a crewed spacecraft.	
JPR 8080.5	G-39	Lighting Protection Design	Applicable		R.LIDS.0100
JPR 8080.5	G-40	Radioactive Luminescent Devices	Not Applicable	No radioactive materials on iLIDS.	
JPR 8080.5	G-41	Acoustic Noise Criteria	Not Applicable	Cancelled	
JPR 8080.5	G-42	Solar Wind Environment	Not Applicable	Cancelled	
JPR 8080.5	G-43	Centralized Subsystem Controls	Not Applicable	Cancelled	
JPR 8080.5	G-44	Attitude Control Authority	Not Applicable	This is a vehicle requirement.	
JPR 8080.5	G-45	Solid Propellant Rocket Motors	Not Applicable	No relative hardware on iLIDS.	

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
JPR 8080.5	G-46	Separation Sensing System - Structural Deformation	Applicable		
JPR 8080.5	G-47	Gyroscopes - Verification of Operational Status	Not Applicable	No relative hardware on iLIDS.	
JPR 8080.5	G-48	Onboard Experiments - Required Preinstallation Checklist	Not Applicable	No relative hardware on iLIDS.	
JPR 8080.5	G-49	Temperature and Pressure Monitoring Requirements of Hydrogen Peroxide System	Not Applicable	Cancelled	
JPR 8080.5	G-50	Direct Procurement of Parts	Not Applicable	Non-functional requirement.	
JPR 8080.5	G-51	Flight Hardware - Restriction on Use for Training	Not Applicable	Non-functional requirement.	
JPR 8080.5	G-52	Reuse of Flight Hardware	Not Applicable	Non-functional requirement.	
JPR 8080.5	G-53	Reverification	Not Applicable	Non-functional requirement	
JPR 8080.5	G-54	Automatic Shutdown of Launch Vehicle Engines	Not Applicable	No relative hardware on iLIDS.	
JPR 8080.5	MP-1	Material Selection, Review, and	Applicable		R.LIDS.0116

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
		Drawing Sign-off			
JPR 8080.5	MP-2	Flammability of Wiring Material	Not Applicable	Cancelled	
JPR 8080.5	MP-3	Toxicity of Materials Used in Crew Compartments - Wire Insulation, Ties, Identification Marks, and Protective Covering	Not Applicable	Cancelled	
JPR 8080.5	MP-4	Metals and Metal Couples - Restriction on Use	Not Applicable	Cancelled	
JPR 8080.5	MP-5	Solutions Which Contain Ethylene Glycol - Requirements for Silver Chelating Agent	Not Applicable	Cancelled	
JPR 8080.5	MP-6	Toxicity - Requirements for Nonmetallic Materials Proposed for Use within Crew Compartment	Not Applicable	Cancelled	
JPR 8080.5	MP-7	Material Detrimental to Electrical Connectors	Not Applicable	Cancelled	
JPR 8080.5	MP-8	Leak Detectors - Wetting Agents	Not Applicable	Cancelled	
JPR	MP-9	Mercury Limitations	Not Applicable	No relative hardware on iLIDS.	

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
8080.5		in Breathable Atmospheres			
JPR 8080.5	MP-10	Liquid Locking Compounds - Restrictions and Controls	Not Applicable	Cancelled	
JPR 8080.5	MP-11	Pressure Vessel Documentation	Not Applicable	iLIDS is not a pressure vessel.	
JPR 8080.5	MP-12	Multilayer Blanket Bake-Out	Not Applicable	Cancelled	
JPR 8080.5	MP-13	Pressure Vessel / Special Pressurized Equipment Design and Certification	Not Applicable	iLIDS contain no relevant hardware.	
JPR 8080.5	MP-14	Silicate Ester Coolant System Design	Not Applicable	Cancelled	
JPR 8080.5	MP-15	Mercury - Restriction on Use	Not Applicable	Cancelled	
JPR 8080.5	MP-16	Restriction on Coatings for Areas Subject to Abrasion	Not Applicable	Cancelled	
JPR 8080.5	MP-17	Radiographic Inspection of Brazed and Welded Tubing Joints	Not Applicable	Cancelled	
JPR 8080.5	MP-18	Etching Fluorocarbon Insulated Electrical Wire	Not Applicable	Cancelled	
JPR 8080.5	MP-19	Spacecraft Material - Restriction on Use	Not Applicable	Cancelled	

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
		of Polyvinyl Chloride			
JPR 8080.5	MP-20	Titanium or its Alloys - Prohibited Use with Oxygen	Not Applicable	Cancelled	
JPR 8080.5	MP-21	Beryllium - Restricted Use within Crew Compartment(s)	Not Applicable	Cancelled	
JPR 8080.5	MP-22	Brazed Joints - Identification Marks	Not Applicable	Cancelled	
JPR 8080.5	MP-23	Pressure Vessels - Materials Compatibility and Vessel Qualification Test	Not Applicable	Cancelled	
JPR 8080.5	MP-24	Cadmium - Restriction on Use	Not Applicable	Cancelled	
JPR 8080.5	MP-25	Pressure Vessels - Non-destructive Evaluation Plan	Not Applicable	Cancelled	
JPR 8080.5	MP-26	Repair of Sandwich - Type Structures	Not Applicable	Cancelled	
JPR 8080.5	MS-1	Equipment containers - Design for Rapid Spacecraft Decompression	Applicable		R.LIDS.0027, R.LIDS.0101, R.LIDS.0103
JPR 8080.5	MS-2	Alignment, Adjustment, and Rigging of Mechanical	Applicable		

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
		Systems			
JPR 8080.5	MS-3	Wire bindles - Protective Coating	Not Applicable	Reclassified as E-25	
JPR 8080.5	MS-4	Crew Hatches	Not Applicable	No relative hardware on iLIDS.	
JPR 8080.5	MS-5	Threaded Fasteners	Applicable		
JPR 8080.5	MS-6	Exposed Sharp Surfaces or Protrusions	Not Applicable	Cancelled	
JPR 8080.5	MS-7	Windows and Glass Structure	Not Applicable	No relative hardware on iLIDS.	
JPR 8080.5	MS-8	Penetration of Inhabited Spacecraft Compartments	Not Applicable	No relative hardware on iLIDS.	
JPR 8080.5	MS-9	Positive Indication of Status for Mechanisms	Applicable		
JPR 8080.5	MS-10	Functional Doors That Operate in Flight	Not Applicable	Cancelled	
JPR 8080.5	MS-11	Meteoroid and Orbital Debris Protection Levels for Structures	Applicable		R.LIDS.0295, R.LIDS.1111
JPR 8080.5	MS-12	Spacecraft Recovery Hoist Loops	Not Applicable	No relative hardware on iLIDS.	
JPR 8080.5	MS-13	Lifting and Hoisting Ground Support Equipment	Not Applicable	Cancelled	

Standard	Section	Section Title	Applicability	Comments/Rationale	Requirements
		Identification			
JPR 8080.5	MS-14	Structural Analysis	Applicable		R.LIDS.0027
JPR 8080.5	MS-15	Stainless Steel Tubing - Method of Joining	Not Applicable	iLIDS has no fluid transfer requirements.	
JPR 8080.5	MS-16	Pressure Vessels - Negative Pressure Damage	Not Applicable	iLIDS is not a pressure vessel.	
JPR 8080.5	P-1	Explosive Devices - Arming and Disarming	Applicable		
JPR 8080.5	P-2	Pyrotechnic Devices Preflight Verification Tests	Applicable		
JPR 8080.5	P-3	Pyrotechnic Circuits - Prohibited Wire Splicing	Applicable		
JPR 8080.5	P-4	Explosive Devices - Packaging Material	Applicable		
JPR 8080.5	P-5	Explosive Devices - Identification Requirements	Applicable		
JPR 8080.5	P-6	Protection of Electrical Circuitry for the NASA Standard Initiator	Applicable		
JPR 8080.5	P-7	Pyrotechnic Devices Color Coding Requirements	Applicable		

Table C-2 To Be Resolved/Determined/Specified (TBR/D/S) Items

TBR/D/S ID	Identity	Title
TBD-2	R.LIDS.1056	iLIDS (-302) Mass
TBD-40	R.LIDS.1115	Pyrotechnic Release
TBD-208	R.LIDS.1092	Control System Safety Requirements
TBR-212	R.LIDS.0202 R.LIDS.1113	On-orbit life for sun hours

Table C-3 iLIDS Configuration Applicability

The following table defines requirements that are unique to specific iLIDS configurations (i.e. -301, -302, etc.). All other requirements are applicable to all configurations.

Applicability	iLIDS (-301)	iLIDS (-302)
R.LIDS.0000	X	
R.LIDS.0041	X	
R.LIDS.0080	X	
R.LIDS.0201		X
R.LIDS.0202	X	
R.LIDS.0295	X	
R.LIDS.1006	X	
R.LIDS.1007		X
R.LIDS.1042	X	
R.LIDS.1056		X
R.LIDS.1072		X
R.LIDS.1103	X	
R.LIDS.1111		X
R.LIDS.1115	X	

Table C-4 iLIDS Rev A to Rev B To/From Comparison

The "To-From" spreadsheet contains red colored text for omissions, blue for new or replaced text and black for no changes. Strike-through means the requirement is deleted.

JSC-63686_iLIDS_PTRS_Rev_B_From-To.x